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Bulletin 151 November 1, 1910

NEW HAMPSHIRE COLLEGE

AGRICULTURAL EXPERIMENT STATION

Twenty-First and Twenty-Second REPORTS

NEW HAMPSHIRE COLLEGE
OF
AGRICULTURE AND THE MECHANIC ARTS
DURHAM

NEW HAMPSHIRE COLLEGE OF AGRICULTURE
AND THE MECHANIC ARTS

NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION

DURHAM, N. H.

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The bulletins of the Experiment Station are published at irregular intervals, and are sent *free* to all residents of New Hampshire requesting them.

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REPORT OF THE DIRECTOR.

To the President New Hampshire College,

Dear Sir: I herewith submit the following report of the work of the Agricultural Experiment Station of the New Hampshire College for the biennial period from November 1, 1908, to November 1, 1910, together with the fiscal report for the years ending June 30, 1909, and June 30, 1910.

Changes in Staff.

There have been three changes in the heads of departments during the period covered by this report and one of these had to do with the administrative affairs of the station.

Prof. E. D. Sanderson, director and entomologist, gave up his duties as director January 1, 1910, but continued to act as entomologist until his resignation September 1, when Mr. W. C. O'Kane, assistant entomologist, was placed in charge of the department.

Prof. Fred W. Morse, vice-director and chemist, who had been connected with the college and station for some twenty-one years, severed his connections with the institution September 1, 1909. Mr. Bert E. Curry, associate chemist, was made acting chemist and on September 1, 1910, chemist.

Prof. W. H. Pew, animal husbandman, resigned September 1, 1909, to take up the position of assistant professor of animal husbandry at the Iowa State College. Mr. T. R. Arkell, an '08 graduate from Toronto University, engaged as associate editor of the Canadian Farm, was appointed September 1, 1909, animal husbandman to the station.

Other changes that have taken place during the past two years among the station workers will be noted later in the departmental reports.

Administration.

Since the writer has been in charge of the administrative affairs of the station only a few weeks, he will not undertake to discuss in this report the work of the station during the past two years, but will depend upon the station staff to present in their departmental reports the main lines of station activity, progress made and some of the value and bearing it has on the agricultural interests of the state.

The business organization of the New Hampshire Station is in excellent shape and reflects credit upon the stewardship of the former director. The station staff comprises well-qualified, earnest, hard-working men who are devoting their best and entire energies to their duties. The station is apparently in a position where it can and will accomplish even more efficient service than ever before.

The policy of the station will be to decrease rather than to increase the number of projects that are undertaken in the different departments, even though there are many problems that are known to exist and that are being continually brought to our attention as being worthy of consideration. We are compelled to adopt this plan because we feel that the undertaking of more

large investigations than facilities, funds and assistance are prepared to properly handle, tends to encourage the turning out of work of a superficial nature. However, new lines of investigation will be taken up and the scope of the work be increased just as rapidly as facilities, funds and assistance are provided to make it advisable.

It is the general plan to have each department select one main line of research which has to do if possible with one of the leading branches of agriculture in the state, and give to it or some part of it their entire attention, taking up only such secondary subjects as have a direct bearing on the problem or that can be carried on without interfering in any way with the most successful completion of the main line of investigation.

This policy if strictly adhered to, should maintain the station and its work on a good solid foundation that will merit the confidence and respect, not only of citizens of New Hampshire, but of other states as well, and this station will come to be recognized as a leader and authority on certain subjects and along certain lines of research.

By assuming this position it does not mean that the station is planning to curtail its activities, but rather it is planned to increase its usefulness through the quality and nature of its work. There are a number of important branches of agriculture that have so far not been given serious consideration at this institution and cannot be taken up until proper provisions are made for it.

Increased Facilities Needed.

Forestry, that makes up so much of the natural wealth of the state, not only directly through the sale of products of the forest, but indirectly through the natural attractiveness of the country, that is responsible for bringing thousands of tourists to our state every year, presents a number of problems which the station cannot afford to ignore, but to properly conduct this work it will be necessary to add an extra man to our force who will devote his entire time and energy to forestry and it is most strongly urged that steps be taken to bring this about at the earliest date possible.

Owing to a lack of suitable buildings and funds for the purchase of livestock, this station has been unable during recent years to carry on experiments that have to do directly with the swine industry which is so closely associated with dairying and holds such an important place in New Hampshire agriculture. Funds should by all means be provided for the construction of a piggery and for the purchase of animals.

There is probably no line of agriculture of greater importance in New Hampshire than that of dairying and it presents many and varied problems that should receive serious consideration at the hands of the Experiment Station. The general interest which is taken in dairy husbandry in New Hampshire is shown by the rapidity with which our supply of bulletins that have to do with this subject become exhausted. It is of the utmost importance that some of the many problems connected with dairy husbandry be taken up and solved and the information be made available to the farmers as soon as possible. However, before extensive work in dairy production can be engaged in, it will be necessary that our present herd be increased in numbers and that better and more representative animals be provided.

More assistance is needed to enable investigations to be conducted in the handling and manufacturing of dairy products which should include the services of a bacteriologist.

The changing of the location of the railroad will destroy the present horse barn which will necessitate the construction of a new one and it is urged that provision be made in the new building for a few extra stalls that will permit the station to take up some lines of horse breeding which is so much needed in the state. Such a course would undoubtedly encourage many more of the New Hampshire farmers to go into the raising of more and better horses.

Poultry husbandry has not as yet received the attention at this station that its importance in the state would warrant There is probably more widespread interest in poultry than in any other one line of farm stock. Practically every farm and many town and suburban lots carry their flock of fowls and the station is continually being called upon to assist poultrymen to solve some of the many difficulties encountered along their line, which the station is not prepared to do owing to the fact that we have no poultry and no facilities for carrying on the work. It is desired, therefore, that means be provided for establishing a good poultry department as it is one of the urgent needs of both the college and the station.

Owing to the lack of sufficient office room in Morrill Hall, it would seem advisable to finish the top floor of the building which is now unused, so that it may be made available for offices and students' agricultural assembly rooms.

Attention should also be called to the needs of the Horticultural Department as indicated in their departmental report, for cold and cool storage accommodations. Also for furnishing and equipping rooms in the Creamery Building for bacteriology and certified milk work.

Exhibits.

Provision should be made whereby the college and station may install exhibits at our leading New England fairs, granges and schools, that have an educational value and that will be illustrative of the character of the work carried on at this institution. This will assist in making the work of this institution better known and appreciated by the people of the state whom it is endeavoring to serve.

Publications.

A large number of the most important publications of this station are now out of print. It requires time to conduct new experiments along these various lines and generally such experiments undertaken must of necessity deal with only a few phases of the subject. The federal funds can be used only for reporting the results of experiments and how they are obtained. The state has so far not appropriated any funds for this purpose; hence, it is easy to see that it is out of the question for the station to meet more than a very small portion of the demands that are being made on it for advice and information through its bulletins.

As a partial remedy for this we would suggest that the state allow a small sum of money to be used for the publication of information bulletins in which not only the work of this station could be set forth, but the work of other stations as well, and also in the bulletins issued by the government, together with the best advice available on the subject. Such publications would be of great

value in assisting to disseminate the best information obtainable where it is most needed, desired, and where it would accomplish the most good.

Coöperation and Demonstration.

There is a large class of people in the state who are interested and engaged in agricultural pursuits who will not and cannot be reached directly by the college and station or its publications. It has been found that they can be reached and most effectively through some form of coöperation and by means of demonstrations that carry the work of the college and station directly to the doors of the men who will use it. Seeing is believing with the average farmer, but when once convinced, experience teaches, he will gladly put into execution such methods and practices as have been shown to bring in the best results in his own neighborhood on his own or similar soils.

The station has already started in a limited way some coöperative and demonstration work in different parts of the state and it has received the most hearty endorsement. Many states are appropriating more money for extension work alone than New Hampshire appropriates for the whole institution. As a result, there is in those states a wonderful agricultural awakening and progress in better and more successful farming methods. It is felt that in no other way can the agricultural interests of the state be better served and the work of this institution become more effective, than through the aid of extension work. This has prompted the request which has been made for a small sum of money to start this line of work in New Hampshire.

The New Hampshire station is and has been for years, supported almost entirely by federal funds and the very least thing that would seem right for the state to do, is to furnish an amount at least equal to the amount of money furnished by the federal government, to supplement and to extend the scope and usefulness of the college and station by means of publications, introducing agriculture into our public schools and by various forms of coöperation and demonstration throughout the state.

County Demonstrations and Experimental Plots.

It would be highly desirable if arrangements could be made so that the station could have the use of a small area of land in each county, such as might be found on many of our county farms, that would represent as nearly as possible the type of soil most prevalent in that county. This would assist in meeting the objections often raised against experiments conducted on the college farm or at any other place in the state.

For example, if it was desired to test varieties of corn as to yield and general adaptability in the state, the results derived from these county test plots should be much more reliable as representing conditions in the state, than if conducted on one type of soil and that not typical, here at the station.

Such an arrangement would enable the station to try out on different types of soils methods of culture, fertilizing, and crop rotations, which would create new centers of neighborhood interest in farming and should prove of much value in determining the agricultural needs of the state and in finding the best means of meeting them.

Respectfully submitted,

JOHN C. KENDALL,
Director.

November 1, 1910.

TWENTY-FIRST ANNUAL REPORT TO THE UNITED STATES GOVERNMENT OF THE HATCH FUND.

For the year ending June 30, 1909.

Receipts.

Cash received from United States treasurer	$15,000.00

Expenditures.

Cash paid for salaries	$6,875.67
labor	2,602.73
publications	481.97
postage and stationery	407.05
freight and express	285.65
heat, light, water and power	913.50
chemical supplies	90.21
seeds, plants and sundry supplies	545.00
fertilizers	122.06
feeding stuffs	163.27
library	358.69
tools, implements, and machinery	85.21
furniture and fixtures	294.99
scientific apparatus	37.98
traveling expenses	864.96
contingent expenses	15.00
buildings and land	106.06
balance	750.00
	$15,000.00

FOURTH ANNUAL REPORT TO THE UNITED STATES GOVERNMENT OF THE ADAMS FUND.

For the year ending June 30, 1909.

Receipts.

Cash received from United States treasurer	$11,000.00

Expenditures.

Cash paid for salaries	$7,370.21
labor	1,698.90
postage and stationery	19.81
freight and express	30.42
chemical supplies	144.25
seeds, plants and sundry supplies	220.81
fertilizers	30.75
feeding stuffs	403.98
library	100.75
tools, implements and machinery	12.94
furniture and fixtures	108.11
scientific apparatus	228.72
livestock	103.40
traveling expenses	75.80
buildings and land	451.15
	$11,000.00

SUPPLEMENTARY STATEMENT OF FUNDS OTHER THAN THE HATCH AND ADAMS FUNDS.

For the year ending June 30, 1909.

Receipts.

Cash received, analytical fees, etc	$4,078.44

Expenditures.

Cash paid for salaries	$900.00
labor	1,767.31
publications	211.58
postage and stationery	75.47
freight and express	39.34
chemical supplies	24.79
seeds, plants and sundry supplies	522.34
fertilizers	73.15
feeding stuffs	82.31
library	46.50
tools, implements and machinery	126.32
furniture and fixtures	372.82
scientific apparatus	50.42
livestock	1.00
traveling expenses	219.42
building and land	236.74
	$4,749.51

TWENTY-SECOND ANNUAL REPORT TO THE UNITED STATES GOVERNMENT OF THE HATCH FUND.

For the year ending June 30, 1910.

Receipts.

Balance from appropriations 1908–1909	$750.00
Cash received from United States treasurer	14,250.00
	$15,000.00

Expenditures.

Cash paid for salaries	$6,469.81
labor	2,219.35
publications	1,838.04
postage and stationery	468.31
freight and express	192.68
heat, light, water and power	1,085.45
chemical supplies	22.08
seeds, plants and sundry supplies	359.88
fertilizers	387.40
feeding stuffs	166.17
library	496.71
tools, implements and machinery	14.15
furniture and fixtures	205.05
scientific apparatus	63.97
traveling expenses	269.71
contingent expenses	15.00
buildings and land	726.24
	$15,000.00

FIFTH ANNUAL REPORT TO THE UNITED STATES GOVERNMENT OF THE ADAMS FUND.

For the year ending June 30, 1910.

Receipts.

Cash received from United States treasurer	$13,000.00

Expenditures.

Cash paid for salaries	$7,479.64
labor	2,435.08
postage and stationery	66.65
freight and express	85.02
chemical supplies	253.48
seeds, plants and sundry supplies	335.47
fertilizers	147.48
feeding stuffs	766.55
library	130.28
tools, implements and machinery	7.00
furniture and fixtures	73.13
scientific apparatus	362.78
livestock	40.00
traveling expenses	176.62
buildings and land	640.82
	$13,000.00

SUPPLEMENTARY STATEMENT OF FUNDS OTHER THAN THE HATCH AND ADAMS FUNDS.

For the year ending June 30, 1910.

Receipts.

Cash received, analytical fees, etc.	$4,034.51
Cash furnished by college	509.93
	$4,544.44

Expenditures.

Cash paid for balance due July 2, 1909	$671.07
salaries	525.00
labor	1,390.87
publications	28.43
postage and stationery	99.95
freight and express	79.07
chemical supplies	211.93
seeds, plants and sundry supplies	139.11
fertilizers	39.20
feeding stuffs	23.51
library	15.73
tools, implements and machinery	27.25
furniture and fixtures	118.12
scientific apparatus	38.56
livestock	1.00
traveling expenses	750.05
contingent expenses	168.85
buildings and land	216.74
	$4,544.44

AUDITOR'S STATEMENT.

The undersigned, duly appointed auditor of the corporation, hereby certifies that he has examined the books and accounts of the New Hampshire Agricultural Experiment Station for the two fiscal years ended June 30, 1910; that he has found the same well kept and classified as above, and that the receipts for the two years from the treasurer of the United States are shown to have been $26,000 and $27,250, respectively, and the corresponding disbursements, $25,250 and $28,000, respectively, for all of which proper vouchers are on file and have been examined and found correct.

And it is further certified that the expenditures have been solely for the purposes set forth in the acts of Congress approved March 2, 1887, and March 16, 1906.

(Signed) C. H. Pettee,
Auditor.

Attest:
Walter M. Parker,
Custodian.

REPORT OF THE DEPARTMENT OF AGRONOMY.

F. W. TAYLOR.

I. ORGANIZATION AND EQUIPMENT.

The principal change in the organization of this department since the last biennial report resulted from the administrative change in the management of the college farm beginning July 1, 1909. By the new arrangement the college farm is run as a commercial proposition under the direct supervision of a college farmer, thus relieving the station agronomist and animal husbandman of the managerial activities formerly necessitated by that work.

The following letter addressed to the director of the station, at his request, sets forth the records of the farm and agronomy department since the writer's connection with the institution.

Durham, N. H., June 1st, 1909.

To E. D. Sanderson, *Director,*
New Hampshire Experiment Station,
as Superintendent of New Hampshire College Farm.

Dear Sir:—I have the honor to transmit herewith a summarized report of the crops, finances and permanent improvements of the New Hampshire College Farm from September first, 1903, to May first, 1909.

F. W Taylor, *Agronomist,*
as Manager of N. H. College Farm.

Farm Crop Report.

The following table will show the number of acres, the total yield and the average yield per acre of the various farm crops including pasture from 1903 to 1908 inclusive.

	1903	1904	1905	1906	1907	1908
Hay, acres	126.00	108.40	107.40	106.00	80.40	73.0
Hay, tons	150.00	149.30	140.20	149.50	120.70	95.8
Hay, average per acre	1.19	1.37	1.35	1.41	1.51	1.3
Ensilage, acres	4.00	10.10	12.60	8.50	11.00	12.5
Ensilage, tons	0.00	73.50	118.20	56.00	109.80	132.0
Ensilage, average per acre	0.00	7.20	9.40	6.60	10.00	10.6
Field corn, acres	0.00	8.00	5.00	4.50	7.80	5.5
Field corn, baskets	0.00	414.00	540.00	322.00	262.00	652.0
Field corn, average per acre	0.00	51.80	108.00	71.00	33.60	118.0
Corn stover, tons	0.00	6.00	8.50	6.10	9.00	10.7
Other grains, acres	0.00	3.50	0.00	1.00	8.50	5.0
Other grains bushels	0.00	0.00	0.00	42.00	320.00	60.0
Straw, tons	0.00	5.20	0.00	1.60	7.50	4.2
Potatoes and turnips, acres	0.00	1.50	0.00	1.00	1.00	0.5
Potatoes and turnips, bushels	0.00	210.00	0.00	225.00	245.00	102.0
Mis. Exp. plots, acres	3.00	1.50	5.50	1.50	2.00	1.5
Hog and sheep lots, acres	0.00	0.00	3.00	3.50	4.00	4.0
Pasture, acres	36.50	43.50	43.50	45.00	54.50	66.0
Trans. to Hort. Dept., acres	4.00	0.00	0.00	2.00	3.50	2.0
Total acres, Agricultural Department	173.50	173.50	173.00	173.00	172.20	170.0

It will be noted from the table that the total acreage of the farm used by the farm department has decreased 3.5 acres since 1903. This decrease has been due to an enlargement of the campus for the erection of new buildings and for the opening of a clay bank. The pasture acreage has been increased almost thirty acres. This was necessitated principally for accommodating the sheep flocks and partly for more cattle pasture. The area used for grain production and experimental plots has also increased since 1903. As a result of these various changes in the cropping system the hay-producing acres have been decreased from 126 acres in 1903 to 73 acres in 1908. There has been, however, a steady increase in the yield per acre of hay during the six-year period, seasonal variations being considered.

Hay Production.

In 1903 the only crop harvested by the farm department, with the exception of a few small experimental plots of millets and alfalfa, was hay. The total yield of hay was 150 tons from 126 acres, being an average of 1.19 tons per acre. About four acres of corn had been planted but this was a complete failure and none was harvested.

In 1907 there was cut 120.7 tons of hay from 80.4 acres, an average of 1.51 tons per acre; in 1908, which was a very dry and unfavorable season for hay throughout the state, 95.8 tons were cut from 73 acres, an average of 1.3 tons per acre. Besides the hay crop in 1908 there was produced 132 tons of ensilage, 652 baskets of corn, and other small grains for experimental purposes.

Appropriations.

For the five fiscal years ending June 30, 1904, 1905, 1906, 1907, 1908, the Board of Trustees appropriated an average of $660 per year from the college

funds for the current expenses of the farm department. For the year ending June 30, 1909, during which period the animal husbandry division was set off from the farm department and conducted as a separate department, the sum of $200 was appropriated for the current expenses of the farm department, and $700 for the expenses of the animal husbandry department. The itemized accounts of the receipts and expenditures of the farm department for the several years may be obtained from the president's financial report to the trustees as printed in the last three biennial reports of the college.

Farm Improvement Account.

In view of the fact that the expenditure for the various permanent farm improvements which were being made from year to year did not appear as such in the regular financial reports a separate account of them has been kept in this office since July, 1906. The following is the summary of such accounts:

July, 1906, to July, 1907, farm improvement work	$1,092.04
July, 1907, to July, 1908, farm improvement work	1,576.01
July, 1908, to July, 1909, farm improvement work	259.25
Total	$2,927.30

Paid, with Experiment Station Funds:

Sheep shed	$84.04
Sheep fence	305.37
Corn crib	67.88
Poultry houses	85.98
Poultry fence	76.10
Sheep barn	1,136.15
Total	$1,755.52

Paid, with Farm Department Funds:

Cementing barn cellar	$28.95
Herdsman room	147.35
New horse stalls	21.35
Ditches and drains	323.63
Graveling barnyard	38.50
New wagon box	17.95
New hay rack	23.14
Iron sluice way	10.00
Cleaning up White lot	109.41
Pasture fence	68.03
Miscellaneous	383.47
Total	$1,171.78

Among the miscellaneous expenditures are such items as, cutting brush, removing old stone walls, digging out stumps and trees, picking stubble stones and constructing and graveling farm roads. In the fall of 1904 the sum of $213.93 was expended for a system of underdrains in one of the experimental fields; this was paid for by the Experiment Station and is not included in the above account. Altogether more than a mile of farm roads have been built and 8,760 feet of drain tile installed since 1903. An average of about $400 per year of farm department funds and nearly $600 per year of Experiment Sta-

tion funds has been expended during the past three years for permanent improvements. During the three years previous to July 1, 1906, although no separate account was kept of such improvements, it is estimated that at least $500 per year was expended for that purpose.

Respectfully submitted,

F. W. Taylor,
Agronomist.

Mr. Jasper F. Eastman, assistant in agronomy, resigned his position, September 1, 1909, to take post-graduate work at the University of Illinois. He was succeeded by Mr. W. L. Slate, Jr. (Ohio State University, '09), who now has the position in both station and college.

In the matter of equipment the most important additions have been the fitting up of a seed-testing room with seed sampler, germinating chamber and sample filing system; also additional units for the filing of experimental data, negatives and photographs, together with other minor tools and conveniences.

II. HATCH FUND PROJECTS.

1. Variety Tests of Corn.

Objects. (1) To determine the comparative yield of corn and stover of the usual varieties of field corn offered by seedsmen and of those commonly grown in various sections of the state. (2) To compare the maturing qualities of the several varieties. (3) To determine the yield per acre, average height, stage of maturity and ratio of ears to stalks of the common varieties of ensilage corn offered by New England seedsmen. (4) To test the theory that a cross between two varieties is more prolific than either of the parents.

In 1909 twenty varieties of field corn were tested on one-fiftieth-acre plots. The yields varied from 23 to 40.6 bushels per acre. Fifteen of these varieties including both flint and dent types were obtained from the United States Department of Agriculture. This season completed a five-year coöperative test with that department of varieties of field corn.

A test made in 1909 of five crosses of dent on flint varieties secured in 1908 as compared with the average yield of the sire and dam, showed an increase in favor of the cross in every case, the difference varying from 2.4 bushels to 11 bushels per acre.

In 1909 a test of thirteen varieties of ensilage corn on one-twenty-sixth-acre plots was made to determine the comparative yields and maturity. The yields varied from 14 to 18.6 tons per acre and the stage of maturity from 0 to 99 per cent.

In 1910 the variety work consisted in testing out on one-quarter-acre plots the four varieties selected from previous years' tests as being the most promising. In this same year a test was also made on one-fifteenth-acre plots in duplicate of different qualities of manure and commercial fertilizer per acre on the yield of ensilage corn. The quantity of manure varied from 15 to 30 loads and the fertilizer from 400 to 1,600 pounds per acre. The detailed results of the fore-

going experiments with field and ensilage corn are to be published in bulletin form during the coming winter.

2. Ear-Row Tests of Corn.

Objects. (1) To show the difference in productivity between individual ears. (2) To secure a highly productive strain of corn by selection and cross-breeding of tested ears. (3) To determine to what extent early maturity can be induced. (4) To determine what tendency there is in this latitude for dent corn to assume the characteristics of the flint type when kept isolated from the latter varieties. (5) To secure a pedigreed strain of dent corn adapted to New Hampshire soils and climate.

The following extracts, records and illustrations taken from a circular recently published by this department will set forth the methods used and results thus far obtained with the work:

The Ear-Row Method.

This method which was originated at the Illinois Experiment Station and which has since been modified and used by various other stations is fundamental to all corn breeding work. Its simplicity, ease of application and definiteness of results readily commend it to the farmer who is trying to improve his strain of corn.

The method consists essentially of selecting ten to fifty ears of corn and planting them in as many different rows, an ear to each row, and later on comparing the yields per row. In our work here we have tested fifty ears each season. In making the selection of ears to go in the test we have followed no definite rule as to the size, shape, weight and markings of the ear, because the relative merits of these points are still more or less in question. The two qualifications which we have insisted upon in all ears are *maturity* and strong *vitality*, for the reason that these qualities are the most essential in all northern climates.

After the ears have been selected, a germination test of each is made by extracting ten kernels from different parts of the ear and testing them in moist sand or blotting paper. If any of the ten kernels fail to germinate the ear from which they came is discarded. The ears are then renumbered, weighed, measured, and photographed in groups of five. They are then shelled and the weight of the cobs taken to determine the percentage of grain, after which the shelled corn from each ear is placed in a separate jar or small bag, properly numbered, and is ready for planting. It would not be necessary and most likely not convenient for the average farmer to make all of these detailed records of each ear, but he ought, at least, to make the germination test and to weigh and measure the ears.

As before stated, the individual ears should be planted in separate rows, a convenient length for which is 100 hills, or about 350 feet. A row of corn 100 hills long with the hills three and one-half feet apart will equal approximately one thirty-sixth of an acre. By planting four kernels to the hill a sufficiently good stand should be secured so that the rows may later be thinned to an average of three stalks per hill. In the fall each row should be cut and shocked

separately, and, when cured, husked and weighed separately. The yields may either be kept in pounds per row or figured to bushels per acre.

By the method as above outlined, the breeding and selection work may be carried on indefinitely. New blood is tested out every year, and the best blood of each year's test is united with the accumulated pure blood of all the previous years' tests. In five years' time a strain of corn will be obtained whose ancestors for four generations are definitely known and have proven themselves to be good producers. In our own work we have this year secured the cross N. H. 400, and next year will have N. H. 500, a strain whose pedigree is known and can be written as shown in the diagram.

The variety of corn we have worked with is the Minnesota 13, a yellow dent type secured from the Minnesota Experiment Station in 1907. The strain of which we have now secured is believed by the writer to be one of the earliest strains of dent corn grown anywhere in the country. For the past two years it has been only a few days later than the earliest flint varieties grown here on the college farm, and in an average season it should mature most anywhere in the southern half of the state.

The ear-row tests and breeding can be conducted with any variety of corn, and although the work may seem to call for a lot of "fussing around" it will be found to be intensely interesting and in the end profitable. The writer would be glad to correspond with any who are sufficiently interested to make a beginning and to give them any suggestions or assistance possible.

3. Variety Tests of Small Grains.

Objects. (1) To determine the comparative yields of grain and straw of the more common varieties offered by the New England seedsmen. (2) To note the seasonal variations and the general adaptability of the different varieties.

In 1909 the following tests were made: Nine varieties of oats on one-fifteenth-acre plots; five varieties of barley on one-fifteenth-acre plots; two varieties of spring wheat on one-fifteenth-acre plots; one variety of spring rye on one-fifteenth-acre plot; one variety of winter wheat on one three-quarter-acre plot. The detailed results of these tests and all those of preceding years were published as Bulletin No. 145, in December, 1909.

4. Fertilizer Tests on Grass Land.

The objects and scheme of this project were published in the last Biennial Report and need not be repeated here. The different fertilizers were applied April 26th and 27th and the grass cut July 7th and 8th in 1909. Owing to the dry season, the effects of the various chemicals were not as noticeable as in previous years, especially where the lighter applications were made. The average yield of the "no fertilizer" plots was one ton per acre. The largest yield was 1.8 tons with an application of 400 lbs. per acre of nitrate of soda. The smallest was .84 tons with an application of 220 lbs. of rock phosphate.

In 1910 the fertilizers were applied April 28th and 29th, and the grass cut July 11th and 12th. The average yield of the "no fertilizer" plots was 1.896 tons per acre. The heaviest yield was 3.41 tons with the application of

400 lbs. of nitrate of soda per acre, and the lightest 1.62 tons with 600 lbs. per acre of land plaster. No second crop was cut in either 1909 or 1910. The effect of lime has not been apparent on any of these plots, either in connection with the various chemicals used or on the "no fertilizer" plots.

This project has been very seriously interfered with by the recent moving of the railroad tracks, it being necessary to abandon eleven of the original plots and replace them by others in an adjoining field. The soil of these new plots is similar to that of the old ones and the grass was sown the same year, *i. e.*, 1905. The new plots are being underdrained like the old ones this fall. The following table will show the comparative average yield of hay from the plots with which no interference has been made for the four seasons during which the test has been conducted:

COMPARATIVE AVERAGE FOR 1907, '08, '09, '10.

	Application per acre.	Hay per acre.
Nitrate of soda	200 lbs.	2,700 tons.
Sulfate of ammonia	150 "	2,376 "
Tankage "9–20" grade	175 "	2,185 "
Land plaster	300 "	1,910 "
Manure	5 tons	2,208 "
Nitrate of soda	400 lbs.	3,115 "
Sulfate of ammonia	300 "	2,656 "
Tankage "9–20" grade	350 "	2,278 "
Acid phosphate 14%	430 "	2,271 "
Rock phosphate	220 "	1,696 "
Basic slag	350 "	2,396 "
Ground bone	220 "	2,530 "
Muriate of potash	120 "	1,963 "
Sulfate of potash	125 "	2,205 "
Wood ashes	900 "	2,335 "
Manure	10 tons	2,410 "
Nitrate of soda Acid phosfate	200 lbs. 215 "	2,576 "
Nitrate of soda Muriate of potash	200 " 60 "	2,560 "
Acid phosfate Muriate of potash	215 " 60 "	2,020 "
Nitrate of soda Acid phosfate Muriate of potash	135 " 145 " 40 "	2,221 "
No fertilizer		2,034 "

5. Alfalfa.

Objects. (1) To note the effect of seed inoculation on the catch and yield secured. (2) To determine the best time of year to sow the seed and the proper amount to sow per acre. (3) To see what type of soil is best adapted. (4) To determine whether lime and what fertilizers are necessary. (5) To note what weeds are most injurious. (6) To see on what soils, in what sections, and by what methods successful stands can be secured in various parts of the state. (7) To study the comparative hardiness and foragevalue of individual plants grown from seed from different sources.

Three cuttings were made this season from the plot seeded in 1909 and a total yield of 3.45 tons per acre secured, and the plot is now in good condition. On another plot seeded in August, 1910, different rates of liming and inocu-

lated *versus* uninoculated seed is being tested. A new alfalfa nursery for testing seed from different sources as well as individual plants has also been started this fall.

6. Pasture Improvement.

Objects. To determine to what extent, by what means and at what expense the average New Hampshire pasture can be improved.

This experiment was instituted in the spring of 1909. The old cow pasture east of the college library was divided into six sections of approximately equal size, and in such a manner that every section would contain at least two small areas sufficiently free from stones and ledges to permit of their being cut with a lawn mower. The several sections were treated as follows:

Section 1 used as a check, no treatment given.
Section 2 harrowed and reseeded.
Section 3 harrowed, reseeded and limed.
Section 4 harrowed, reseeded, limed and fertilized.
Section 5 plowed and reseeded in later summer with no fertilizer.
Section 6 to be pastured by sheep for three years.

The harrowing was done with a Cutaway harrow set at such an angle as to cut well, but not to invert too much of the sod, the ground being gone over three times alternately at right angles. The grass seed mixture used per acre was as follows:

Timothy, 10 lbs.
Redtop, 5 lbs.
Kentucky Bluegrass, 10 lbs.
White clover, 5 lbs.

The lime was the "Rockland-Rockport" brand and was applied at the rate of one ton per acre.

The fertilizer was made up of 700 lbs. nitrate of soda, 1,000 lbs. ground bone and 300 lbs. muriate of potash and was applied at the rate of 500 lbs. per acre.

The sixth section was fenced off and pastured by sheep during the seasons of 1909 and 1910 and will be again in 1911. As many sheep are kept on this section as it will support without additional grain feed. A record is being kept of the number of sheep and the length of time they are maintained on the section during each season. The various treatments for sections 2, 3, 4 and 5 were given only in the season of 1909, but their effect is to be noted and measured as accurately as possible for at least four years. The cost per acre of each of the several treatments has also been accurately kept.

As a means of measuring the effect of the several treatments, two of the most uniform spaces in each section, twenty-four feet square, have been fenced around, and in each enclosure an area equal to one-one-hundreth-acre has been measured off. This one-one-hundreth acre is cut as often as necessary during the season with a lawn mower, having an apron attached for collecting the cut grass. A record of the weight of green grass cut from each enclosed area is kept for each year and this is taken as a result of the amount of pasture furnished by that section for the year.

As this project is to continue for a period of four years no definite results can be given until its completion. It appears, however, from the results thus far obtained that plowing and reseeding is the most efficient as well as the most economical method of increasing the yield of grass on these old pastures.

III. CO-OPERATIVE EXPERIMENTS.

The only coöperative experiments being conducted by this department in addition to those previously mentioned with alfalfa, are tests of methods to increase the yield of hay on old mowing lands. This work was begun in the spring of 1910 with the following particular objects in view: (1) To demonstrate by which of five simple methods the yields of hay on an average New Hampshire meadow can be most greatly increased. (2) To determine the cost of the increase produced by each method in the several communities. (3) To indicate whether lime has any effect on the soils in question in promoting the growth of clover. (4) To bring the Experiment Station and the college into a closer and more favorable contact with the farmers of the state.

Method of Procedure. Fields which had been in sod for several years, and which had as uniform soils and stands of grass as possible were selected and divided into six sections of one-half to one-quarter-acre each, depending upon the total amount of land available. Section 1 was top-dressed with barnyard manure at the rate of twelve loads per acre. Section 2 was top-dressed with a complete chemical fertilizer at the rate of 600 lbs. per acre. Section 3 received no treatment. Section 4 was top-dressed with nitrate of soda at the rate of 400 lbs. per acre. Section 5 was plowed and reseeded in the fall without fertilization. Section 6 was plowed and cultivated to corn or potatoes for one season and then seeded down.

The grass seed used consisted of a mixture of 40 lbs. of Timothy, 20 lbs. of redtop, 30 lbs. of red clover and 20 lbs. of alsike clover, and was applied at the rate of 30 lbs. to the acre.

This combination of tests will indicate first the effect of three common top-dressing materials; second, the effect of simply stirring the soil and reseeding; and third, the effect of cultivation and crop rotation. One half of the section simply plowed and reseeded was limed for the purpose of seeing to what extent the lime would induce the growth of clover. The various top-dressings are to be applied every spring during the period of the test, while sections 5 and 6 are to receive no treatment after being seeded down. The hay from each section is to be weighed carefully each year and an account of the value of the fertilizers used and the cost of the grass seed and labor of seeding down is to be kept, so that the actual profit or loss of each treatment for the series of years may be known. The Experiment Station furnishes the grass seed and the fertilizers with the exception of the manure, outlines the details of the experiment, assists in keeping the notes, and has a representative visit those conducting the tests at the time their grass is cut.

The following farmers of the state are coöperating in these tests: Royal Jordon, Colebrook; Walter Eaton, Whitefield; Everett H. Smith, East Haverhill; J. B. Foster, Quincy; D. T. Atwood, Plymouth; H. S. Townsend, Lebanon; and Nelson Merrow, Lancaster.

The following table shows the yields of hay from the various plots in the several localities for the season of 1910:

Name of Coöperator.	Date of cutting.	Nitrate Plot.	Comp. Fert. Plot.	Manure Plot.	Nothing Plot.
H. S. Townsend	July 18	5,668	4,648	3,846	2,706
D. T. & E. E. Atwood	July 21	2,948	2,740	2,364	1,656
Everett H. Smith	July 15	5,320	6,360	5,340	3,720
J. B. Foster	July 14	2,712	2,792	2,428	1,328
Nelson Merrow	July 18	5,806	5,116	3,876	3,494
Royal Jordon	July 20	2,478	2,650	1,752	1,114
Walter Eaton	July 8	4,000	3,000	2,500	2,000
Average		4,137	3,901	3,158	2,288

Note.— Results as tabulated are in pounds of hay per acre.

IV. EXTENSION WORK.

The amount of work of this nature which the department has been able to do has been limited both for lack of appropriate funds and time for its execution. During the past two years the writer has given about forty public addresses at grange, farmers' institute and other meetings. Numerous requests for addresses at other gatherings have been denied because of the pressure of college and regular routine work. A few visits have been made in an advisory capacity to farms in various sections of the state, but the majority of requests for such visits have had to be refused on account of the lack of time and opportunity to make them.

The correspondence of the department has about doubled during the past two years, about eleven hundred replies having been made to letters for information since November 1, 1909. The greatest volume of correspondence comes in the spring and has reference to the purchase and use of fertilizers, the planting of seeds and the improvement of mowing lands.

The only fair at which an exhibit has been made since 1908 was the Union Grange Fair held at Plymouth, N. H., in October of this year. The exhibit included two cases of grains and forage crops, 12 half-bushel cans of threshed grains, exhibition jars of fertilizers and grass seeds, and a series of glass tubes illustrating graphically the results on hay yields from top-dressing.

One of the most urgent needs of the department is an appropriate fund for extension work because it is felt, from the limited amount which has already been done, that there is no line of work which appeals more directly to the farmer and which will result in bringing the farmers and the Experiment Station into closer contact and sympathy.

Other needs of the department commented upon elsewhere in this report are:

1. Suitable land for field crop experiments.
2. A small plant house for soil fertility work.
3. A second assistant for experimental work.

V. PUBLICATIONS.

The publications issued by the department in bulletin or circular during the past two years are as follows:

Soil Studies, Bulletin, school series, May, 1908.

Seed Testing, Bulletin, school series, January, 1909.

Variety Tests of Oats, Bulletin, Number 145, regular series, December, 1909.

Alfalfa in New Hampshire, Circular No. 9, June, 1910.

Breeding and Selection of Corn, Circular No. 10, October, 1910.

Results of Seed Tests, Bulletin No. 148, regular series, September, 1910.

The last named publication gives the results of 238 seed examinations made during the year under the provisions of the new state Pure Seed Law. The agronomist of the station has been appointed the agent of the secretary of the State Board of Agriculture, who has charge of the administration of the law, and has been instructed to make the official tests and publish the results annually as a regular bulletin of the Experiment Station.

REPORT OF THE DEPARTMENT OF BOTANY.

CHARLES BROOKS.

The work of the department has continued as outlined in earlier reports. Most of the time of its staff has been given to the study of plant diseases. Investigations have been made to determine the nature of these diseases and experiments carried on to find methods of control.

The department has recently been given charge of one wing of the college greenhouse and is now able to carry on investigations to much better advantage than formerly.

Fungicides and Spraying.

The interest in spraying has increased enormously in New Hampshire within the past few years and there has been an urgent demand for fuller information in regard to safeness and efficiency of fungicides. Bordeaux mixture has proven very efficient in controlling diseases, but has often produced serious injury on foliage and fruit. It would mean a great saving to the people of the state if the various fungicides could be tested under New Hampshire conditions and accurate data obtained as to their value. Information of this sort when brought within reach of those interested, should prevent much of the loss in the state resulting from the use of inefficient and unsafe materials. The department has been endeavoring to obtain such information. In the summer of 1909 spraying experiments were made on the control of scab and leaf spot in two McIntosh orchards in Deerfield, N. H. The past summer similar experiments have been conducted in the Baldwin orchards of A. R. Marsh and George E. Gowen of Stratham, N. H. The self-boiled, commercial and home-made lime-sulfurs have been tested alone and combined with various insecticides. They have given practically no injury under conditions that resulted in serious damage from Bordeaux. In 1908 and 1909 they held the diseases in check as well as Bordeaux, but the work of the past season

has shown that, owing to the readiness with which sulfur mixtures are washed from the tree, frequent applications will be necessary to control diseases in rainy seasons. No fungicide has proven so uniformly efficient as Bordeaux.

Arsenate of lead has given no injury when combined with lime-sulfur. Slight injuries have resulted from Paris green in commercial lime-sulfur when there was no excess of lime. Arsenite of lime has given no injury when used with lime-sulfur accompanied by an excess of lime.

Some of the above results have already been made public in Press Circular No. 13 and Bulletin No. 144 and other data will be published later.

Fungous Diseases.

A study has been made of diseases as they have occurred. Special attention has been given to some of the diseases of the apple, tomato and bean. The investigations on the apple and tomato diseases are being carried on under the Adams Fund.

Leaf Spot of Apple.— Notes have been taken and inoculation experiments made to determine the time when infection takes place. The results indicate that the fungus seldom gains entrance to the host after the middle of June but that on water sprouts and other tender growth the leaves may be infected several weeks later. The fact that the disease makes its beginning so early in the season shows the importance of early sprayings. The past season has been a good one for the demonstration of the relation of Sphæropsis cankers to leaf spot. The leaves beneath these cankers have frequently been found to be covered with spots while those near by would be practically free from the disease. The destruction of these cankered limbs would do much toward preventing the leaf spot as well as the black rot of the fruit, for these two diseases have been found to be due to the same fungus as produces the cankers.

Apple Scab.— The spraying experiments mentioned above have shown the importance of the applications before the blossoms open in the control of apple scab. Apples but slightly affected with this disease when allowed to stand in the barrels for considerable time before being placed in cold storage, have been found later to have developed the disease to such an extent that they were scarcely marketable. It is important that apples should be stored as soon after gathering as possible even if entirely free from disease.

Fruit Spot of Apple.— This disease was rather fully discussed in an earlier report and is still under investigation. It has not been so serious the past season as in other years.

Tomato Diseases.— Investigations are being made upon several tomato diseases. It is thought that when the data is complete the results will be of both scientific and practical interest.

Coöperation.

The spraying experiments of the summer of 1909, described above, were carried out in coöperation with the Bureau of Plant Industry of the United States Department of Agriculture, each party bearing one half the expense of the work.

For the past two years the head of the department has worked in coöperation with the Bureau of Plant Industry in attempting to secure a more com-

plete knowledge of the diseases of the state. By this means the department has had the franking privilege for specimens of diseased plants and has thus often been able to secure more material, larger specimens and a better knowledge of the diseases as they occurred.

Relations to the Public.

A number of Riker Mounts have been prepared illustrating the most serious plant diseases of this section. These have been sent out to fairs, horticultural meetings, etc. The department has had a series of lantern slides made showing the diseases of the apple and the results from spraying. These have been used in illustrating lectures upon this subject.

The correspondence of the department has had a marked increase within the past two years. Most of the inquiries have been in regard to the identity and prevention of diseases, but there have been frequent requests for the identification of weeds and other plants.

Needs of the Department.

One of the great needs of the department is an opportunity to become more familiar with the conditions of the state. Its station expenses are met almost entirely from funds that must be used for research work and there is, therefore, little opportunity for its staff to give time to demonstration work, to the preparation of illustrative material or to a study of conditions in various parts of the state. Much of the time of the department is required to meet its teaching obligations and there have frequently been calls for the investigation of diseases reported to be serious at times when the college and research work required the entire time of its staff. A small increase in the amount of money paid to the department for salaries would enable it to place one member of its staff entirely on station work. This, together with a fund that could be used in extension work, would enable it to be of much greater service to the public by making it possible to visit different parts of the state, to learn about diseases as they occur, to carry on research work in harmony with the needs of the state, to make demonstration experiments, and to give more time to the preparation of demonstration material.

REPORT OF THE DAIRY DEPARTMENT.

FRED RASMUSSEN.

During the past two years the Dairy Department has not been officially connected with the Experiment Station, for the following reasons:

(1) The equipment and facilities were inadequate for doing experimental work.

(2) The department staff consisted of one man whose time was required for teaching and for work on a new dairy building, which has just been completed.

The department has, however, taken care of considerable correspondence, supervised the official testing of dairy cows and execution of dairy laws.

Testing of Pure Bred Cows.

Requests have been received from several breeders of Guernsey, Jersey, Holstein and Ayrshire cattle for the supervision of the station in conducting weekly or yearly tests of their animals under the rules of their respective associations. Since the issuing of the last Biennial Report, the following tests have been completed; 45 Holstein, 26 Ayrshires, 9 Guernseys and 6 Jerseys, a total of 74 as compared with a total of 20 for the two previous years.

Execution of Dairy Laws (Act of 1901).

The act demands that any person who operates the Babcock test, or any other test, for determining the butter-fat or solids in milk and cream, as a basis for apportioning the value of same, must hold a certificate from the proper station official showing the holder competent and well qualified to perform such work. The law further provides that all glassware used in connection with the testing must be tested for accuracy of graduations.

During the last two years thirty-six candidates have been examined and granted milk-testing certificates.

Three thousand and seventeen pieces of glassware were examined for accuracy of graduation of which sixty-eight pieces or 2.25% were inaccurate or defective.

There are many problems both along the line of the production and handling of milk as well as in the manufacturing of dairy products, the investigation of which would be of benefit to the dairymen in the state. With the new dairy building completed and nearly equipped the department has excellent facilities for carrying out experimental and research work. It is, however, impossible for the department to carry on experimental work until additional assistants are employed. It is especially urged that as soon as possible a dairy bacteriologist be connected with this department and that provision be made for at least one half an assistant's time for experimental work.

REPORT OF THE DEPARTMENT OF CHEMISTRY.

B. E. CURRY. T. O. SMITH.

Since the last report was issued the following changes have taken place in the Department of Chemistry. On September 1, 1909, Prof. F. W. Morse severed his connection with the department. In April, 1910, Mr. T. O. Smith was appointed assistant chemist and in September, 1910, B. E. Curry was appointed chemist.

The miscellaneous work has been increasing in amount during the last biennial period. During this time 255 samples of fertilizers and 226 samples of feeding stuffs have been analyzed for the State Board of Agriculture. During the preceding period 160 samples of feeding stuffs and 210 samples of fertilizers were analyzed, an increase of 66 samples of feeding stuffs and an

increase of 45 samples of fertilizers; or, a 40% and 20% increase, respectively. The expense of this is met by the State Board of Agriculture.

Frequent requests are received from individuals for analysis of fertilizers, feeds, soils, etc. When the results of these analyses are of public or general interest they have generally been made. Analyses of materials of only individual or personal interest are not usually made. At present no provision is made for such work in the department.

Analytical assistance has been supplied for other departments in the station when needed for experimental purposes.

In the general analytical work, especially in the analysis of fertilizers and feeding stuffs, the department has had the assistance of Messrs. W. L. Adams, C. H. Reynolds, J. E. Robinson and C. H. Robinson.

Investigations under the Hatch Act.

Time Requirements of New Hampshire Soils.

During the past year the department has begun a study of the lime requirements of New Hampshire soils. General observations point to the fact that lime is useful only for a part of the soils. At the same time lime is being generally recommended from some sources for all kinds of soils regardless of profit or loss to the farmer.

The object of this work is to study such soils as respond to applications of lime and determine what differences exist between these and soils that are not affected by lime.

As a beginning about thirty series of plots or small fields have been seeded to grass and clover and a portion of each has been limed. These plots consist of the various types of soils found generally throughout the state.

Data now at hand which has been obtained from observations made on boulder clay, loam overlying clay, and one or two lighter types of soil, do not show any effects from applications of lime. Observations now at hand do not point to a general need for lime, but do emphasize the necessity for more information about the lime requirements of our soils before the use of lime becomes general. From information now at hand it is certain that at least a part of our soils will not give returns for money expended for lime.

Experiments carried on with Adams Funds.

The Study of Soil Potash.

The progress of this work up to October, 1909, is included in Bulletin No. 142. Since that time the investigations have been extended to lighter types of soils and now the department has under observation types varying from heavy clay loam to very light sandy soils. No general conclusions can as yet be drawn from the observations on the lighter types.

Results obtained from the heavier clay soils are as follows:

For grass and clover potassium fertilizers are not essential to the growth of good crops. The application of potassium salts does not affect the yields nor the composition of the crop. These observations point to the fact that the potassium in the clay soils is sufficiently soluble at all times to furnish plenty of potassium for the needs of growing grass and clover. The practical

importance of this is due to the fact that it shows that potassium can be eliminated from the grass fertilizers for clay soils and without affecting the yields.

During the past year observations have been made to determine the effects of tillage on the soil potash. The moisture content of the soils on the cultivated and uncultivated plots remained the same throughout the growing season. Also the water soluble material extracted from the soils from the cultivated and uncultivated plots was the same. So far as any observations could be made on the plots in question, the growth of the crop, amount of soil moisture, amount of water soluble soil, organic and inorganic extracts, were independent of the cultivation. This will be continued another season.

Coöperative experiments as such are not being carried on by the Chemistry Department. On the other hand observations are being made on different soils on farms in different localities. Most of these are made on newly seeded grass fields. Plots in about thirty-five different places are now under observation.

During the last biennial period the department has coöperated with other stations in working up data for new methods for determining nitrogen and potassium.

It has been the custom of the department to make the analyses for the feeding stuffs and fertilizer inspection during the summer months and to depend upon student help. The large increase in the amount of this sort of work makes this method no longer satisfactory. In order to do this work justice new arrangements must be made, so that the work may be commenced earlier and the results published at least before the sales of feeding stuffs and fertilizers begin for the succeeding season.

REPORT OF THE DEPARTMENT OF HORTICULTURE.

B. S. PICKETT.

ORGANIZATION.

The experimental work of the Department of Horticulture has been carried on during the past two years under the immediate supervision of the head of the department, assisted by men in the several branches of pomology, olericulture and floriculture. The following changes have been made in the staff:

In February, 1910, W. H. Wolff, M. S., Pennsylvania State College, succeeded Mr. W. H. Wicks as assistant in pomology, Mr. Wicks having accepted a position as professor of horticulture in the University of Idaho.

In July, 1909, T. G. Bunting, B. S. A., Ontario Agricultural College, was appointed assistant in olericulture. After a year of very satisfactory service, Mr. Bunting resigned to accept a position with the Canadian government, and was replaced on September 1, 1910, by J. J. Gardner, B. S., Massachusetts Agricultural College.

INVESTIGATIONS UNDER THE HATCH ACT.

Variety Test of Plums.

The variety plum orchard was set in the spring of 1908, this being its third season of growth. A number of varieties blossomed this spring, but owing to cold weather during blossoming time, insects could not pollinate the flowers, and no crop was set. The trees in this orchard are making a remarkably vigorous growth, the shoots for all varieties averaging thirty inches at least.

Variety Test of Apples.

The variety apple orchard is a young plantation that previous to 1908 received little care of any kind. It is located on a rocky ledge where cultivation is very difficult. The sod in this orchard was broken up in the fall of 1908 and the land has gradually been brought into a state of tilth. The trees are now making a satisfactory growth and several varieties including McIntosh, Wealthy and Hyslop crab came into bearing for the first time this year

Variety Test of Lettuce.

This project consisted in the preparation of a monograph on the varieties of lettuce. All varieties cataloged in American seed catalogs and the standard varieties cataloged in European catalogs were tested. Altogether four crops have been grown.

Lettuce Culture under Glass.

The experiments on the cultivation of lettuce under glass included tests of several standard fertilizers and a comparison of the value of romaine or cos lettuce and head lettuce for greenhouse culture. The results of the fertilizer tests resulted in new evidence favoring the use of stable manure as a fertilizer for this crop. In the comparison of the two types little difference was noticed. Romaine or cos lettuce proved rather the more profitable crop but this was found to be due to market conditions as much as to advantages in culture.

Carnation Culture.

These experiments were made to determine the relative values of several fertilizers applied as top dressings, to carnation plants grown on raised benches in the greenhouses, and to determine the difference in the keeping quality of flowers from the various treated plots.

Plants responded quickly to treatments with nitrate of soda, Clay's fertilizer and poultry manure. The best results were obtained in the plots which were fertilized with nitrate of soda and with Clay's fertilizer. In the plots fertilized with poultry manure, the flowers appeared late and were inferior in keeping quality. In keeping quality the flowers raised on the plot treated with bone meal proved superior to all others. Second in rank as regards keeping quality were the plots treated with Clay's fertilizer.

In all cases the fertilized plots produced flowers superior in size and quality to those produced where no fertilizers were used.

Variety Test of Small Fruits.

This experiment was planned in 1909 and was to have been commenced in the spring of 1910. Owing to the lack of funds, however, no arrangements

could be made for the commencement of this work. Such a test would be of great value to the fruit industry of the state.

EXPERIMENTS UNDER ADAMS FUND.

Fruit Bud Formation Project.

All the work arranged for under this project has been carried out exactly as outlined throughout the entire season and the results have been striking and thoroughly satisfactory. The general plan of this experiment consists in the comparison of various cultivation and fertilizer treatments, in an apple orchard consisting of some three hundred trees. The experiment has now been in progress for three seasons. No results of marked value could be observed previous to 1910, but during the present season, very marked differences have appeared in the various plots, among the most striking of which are the following.

The rate of wood growth in plots cultivated every other year was approximately double that of plots not cultivated, and in plots which were cultivated every year the rate of wood growth was double that of plots cultivated every other year. No marked difference was shown in rate of wood growth between plots cultivated, but unfertilized, and plots which were both cultivated and fertilized. At the date of writing the records on the crop have not been completed. A careful estimation of the amount of blossoms made by three separate examinations of the individual trees throughout the orchard (a better index probably than a record of the number of fruits produced so far as a study of fruit bud formation is concerned) indicated the relative number of fruit buds formed in the various plots. The differences were as follows:

Plot	Fertilizer	Cover Crop	Culture	Per cent of full bloom
I	None	None	In sod	9 1
II	None	None	Culture odd years. In sod even years	38.6
III	None	None	Alternate with II	57.0
IV	None	None	Culture till Sept. 15	42.7
V	None	Crimson clover July 10	Culture till July 10	59.1
VI	Normal amounts N. K. P.	Crimson clover July 10	Culture till July 10	43.1
VII	Normal amounts N. K. P.	Crimson clover July 10	Culture till July 10	53.4
VIII	Excess P	Crimson clover July 10	Culture till July 10	39.1
IX	Excess N	Crimson clover July 10	Culture till July 10	44.5
X	Excess K	Crimson clover July 10	Culture till July 10	62.7
XI	Lime cross plot	Crimson clover July 10	Culture till July 10	57.6
XI[10]	Excess K and Lime	Crimson clover July 10	Culture till July 10	77.6
XI[9]	Excess N and Lime	Crimson clover July 10	Culture till July 10	52.25
XI[8]	Excess P and Lime	Crimson clover July 10	Culture till July 10	39.0
XI[7]	Normal and Lime	Crimson clover July 10	Culture till July 10	56.8

The total crop harvested from this orchard amounts to 550 barrels. The apples from individual trees have all been counted, so that accurate data will be yielded.

To make this experiment thoroughly effective, we need to obtain temperature records at various points in the orchard, records of amount of rainfall, and determinations of the moisture content of the soil in the various plots throughout the growing season. This experiment is so promising at the present time that the writer feels that the expenditure of a considerable sum of money in making these suggested determinations is very advisable.

Plant Breeding Project.

Included under this heading are the experiments in breeding of squashes, muskmelons and carnations, together with the studies in the correlations between fruit and foliage in the strawberry. The work under this head is too voluminous to be readily summarized in a short report. Strong confirmation has been obtained of the working of Mendel's law in hybrids between different well-marked types of squashes and muskmelons. Very complete sets of data have been obtained as a result of these studies. Photographic records have been carefully preserved and some valuable negatives made by the Lumiere process of colored photography have been made showing not only the varying proportions in form, but also the varying colors that were found in succeeding generations of hybrids.

The work in carnation breeding has been less systematic and has resolved itself into two phases, first a search for pure types and, second, for valuable variations that would be useful in commercial work. During the past season pure color types were isolated and crosses made between them. These are expected to show Mendelian proportions in the F_3 generation. One valuable new crimson carnation was discovered last season, and is being propagated at the present time.

The gathering of data connected with the correlation experiments has been completed and is now being summarized. The work includes the records on the fruit and foliage on 931 seedling strawberry plants. Each of these plants was grown by the hill system. The berries were gathered separately, each berry was weighed and its volume determined by a bouyancy test It was also described as to form, color, embedment of seeds, character of base, character of apex and color of seeds. Immediately after fruiting, all the leaves from each plant were gathered, tied in bundles, and preserved in formalin. Twenty representative leaves chosen at random were measured from each plant by means of a planimeter. It is expected that as a result of these measurements it may be determined whether correlations exist between the size of leaves and the size of fruits and the total amount of foliage and the total amount of fruit.

Demonstrations.

Demonstrations in orchard practice have been conducted at Manchester, Goffstown and Warren.

The first demonstration was given in the orchard of S. Corey and Son, Manchester, N. H. It consisted in the pruning of apple trees. Mr. W. H.

Wolff, who had charge of this demonstration, reported a good attendance, and the Manchester press spoke highly of the success of the demonstration.

The second of these at the fruit farm of Albert Freeman was very largely attended by farmers around Manchester. It consisted in a talk on the spraying of apple trees, together with a practical demonstration of the preparation of Bordeaux mixture and arsenate of lead and its application to trees.

The third demonstration was held at the farm of Stanley K. Lovell of Goffstown. A still larger number of people were in attendance than at the previous demonstrations. The work was of practically the same character as at the Freeman place.

The fourth demonstration was less largely attended, as it was out of the usual district for apple growing.

A demonstration of considerable importance was held at the College at Durham during the meeting of the Farmers' One Week Course. In this all operations in the renovating of an old apple tree were performed, including pruning, cultivation of the ground, fertilizing, and scraping of tree trunk.

I am convinced that in no other way can orchard practice be so considerably improved in so inexpensive a manner as by the making of these demonstrations. In all the cases above referred to, the initiative was taken by the parties at whose orchards the demonstrations were given and even the advertising of the same was undertaken by the parties interested. These facts are an indication of the favorable response that this line of extension work is certain to meet with from the fruit growers of the state.

Extension.— During the past two years the head of the department has spoken at ten farmers' institute meetings, ten grange meetings and twelve or more meetings of other organizations within the state. Other members of the staff of the department have addressed as many more meetings of granges and various other organizations.

The department has exhibited twice during the past year at agricultural exhibitions, one at Plymouth, N. H., and the other at the exhibition of the New Hampshire Horticultural Society at Manchester. Neither of these exhibits was large, owing to the fact that no funds are available for the gathering together of material for such an exhibit. Considerable interest, however, was evoked as a result of these exhibits, and if funds can be obtained to enlarge the scope of these exhibits, a promising field of work will be opened for the department.

Correspondence.— The amount of correspondence is large and is rapidly increasing. The most important, though not the most voluminous part consists in replies to requests for information on various subjects connected with horticulture. Many persons have become regular correspondents, owing, I am convinced, to the fact that painstaking care is exercised in replying to every individual inquiry. The writer estimates the inquiries received by this department at 800 during the present year and at 500 for the year 1909. There has been a larger correspondence carried on by the department during the years 1909 and 1910 than in all the previous history of the department combined. I wish to call attention to the importance of this means of popularizing the college among the people of the state.

Needs of the Department.

Assistance.— I recommend that an assistant be appointed to have charge of the work in the greenhouses involved in the several experimental projects, which from time to time may require the use of the greenhouses; and that a graduate student assistant be employed to assist in carrying out the details of many of the projects under way.

Permanent Improvements.— The department is much in need of a cool and cold storage house provided with the proper packing rooms for vegetables and fruits. The need of adequate storage for [vegetables has never been treated in an experimental way by any agricultural experiment station. The cold storage of fruits has received attention from four experiment stations in other states, but has not been adequately touched upon by this Experiment Station. The writer believes that the practicability of a storage house using wood, paper and dead air spaces as insulating materials and ice as a refrigerant should be demonstrated for the benefit of the orchardists of this state, who at the present time are compelled to unload their fruits at harvesting time at such prices as the dealers may choose to set.

The most important need of the Department of Horticulture is suitable land on which to carry out experimental work. There does not exist on the farm of the New Hampshire College any area of land sufficiently large, of uniform physical character or content of fertility to be suitable for the obtaining of accurate results from variety tests, fertilizer experiments, methods of cultivation, or other experimental data immediately connected with the culture of crops of the garden or the orchard. This is a matter of such importance that it cannot be too strongly emphasized in this report. The remedy must consist in the lease or purchase of suitable areas of land for the purpose of experimentation.

REPORT OF THE DEPARTMENT OF ANIMAL HUSBANDRY.

T. R. ARKELL.

Organization and Equipment.

Experimental work in this department is confined entirely to investigations in the breeding and feeding of sheep. Owing to the lack of proper accommodations it is not possible to maintain hogs. Before effective experimental work can be accomplished with hogs, it is necessary that a suitable hog-barn be erected, since at the present time no building whatever is provided for this purpose. This department also has crying need for a poultry plant. The high prices for eggs and dressed poultry that prevail in the state throughout the entire year and the proximity to the great Boston market make poultry raising a most important industry. The Experiment Station can be of little material assistance in this regard to farmers in the state unless it be equipped with a poultry plant wherein investigations may be pursued to discover methods of management most adaptable to New Hampshire conditions.

One of the first duties of the animal husbandman, after his appointment in September, 1909, was the erection of a sheep barn large enough to accommodate seventy-five head. This barn is provided with a small root cellar in one end, and also with a compartment, the walls of which are securely double boarded so as to form a still-air space, where lambs can be dropped without danger from cold even in the most inclement winter weather.

Another valuable addition to the equipment of the department is a fibre-testing machine which was purchased in March, 1910. This appliance is used for obtaining the tensile strength, elasticity and length of wool fibres which factors must be determined in order to gain information anent the manner of inheritance of the many characteristics that comprehend what is commonly called wool quality. Consequently, for prosecution of the sheep breeding work, the department is now well equipped.

Prof. J. C. McNutt, who had acted as assistant in this department since 1908, resigned his position in August to accept a similar one in North Carolina College of Agriculture. We have, however, been most fortunate in securing for this position Prof. O. L. Eckman, an '04 graduate of Ohio State University.

Investigations.

All investigations are included in three main projects:

1. Sheep Breeding (Adams Fund).
2. Sheep Feeding (Hatch Fund),
   a. Clover hay *versus* New Hampshire native hay;
   b. Value of turnips in the ration.
3. Tobacco Feeding for the Eradication of the Stomach Worm in Sheep, *Hæmonchus contortus.* (Hatch Fund.)

1. Sheep Breeding.

This project is being carried on under the Adams Fund in coöperation with Dr. C. B. Davenport, station for experimental evolution, Carnegie Institution of Washington, Cold Spring Harbor, L. I.

The primary object of the experiment is to discover the manner in which characters are inherited with relation to the Mendelian law. However, coincidentally with the prosecution of the original plan, four new branches have been opened up and carried on:

a. Crosses and methods of management best adaptable for early or "hot-house" lamb production.

b. Experimental breeding of multi-nippled sheep *inter se* and upon the ordinary two-nippled breeds in order to discover the behavior of these two classes of nipples in heredity.

c. Compilation of data in respect to the inheritance of twins which is being pursued by means of circular letters sent to all the leading sheep breeders in America and by a study of the flock books.

d. Determination of post-natal variation in the growth of sheep and particularly in the growth of the large bones of the extremities.

The experiment was commenced in 1908 when four rams of the Dorset, Hampshire, Shropshire and Southdown breeds were mated with seventy-eight ewes: the Dorset ram with nineteen ewes; the Hampshire ram with

twenty-six ewes; the Shropshire ram with thirteen ewes; and the Southdown ram with twenty ewes. The flock with the Dorset ram included six Dorset ewes, eight Merino ewes, two Southdown ewes and three New Hampshire native ewes; with the Hampshire ram, four Hampshire ewes, fourteen Merino ewes and eight New Hampshire native ewes; with the Shropshire ram, three Shropshire ewes, six Merino ewes and four New Hampshire native ewes; and with the Southdown ram, eight Southdown ewes, five Merino ewes, three Dorset ewes and four New Hampshire native ewes. In 1909 similar matings, using in all instances the same sheep as in the previous year, were made. As it is by no means a good plan to breed ewes as lambs, no matings of the F_1 generation were made until this fall, and then only those dropped in 1909 were used. Consequently, so far we have obtained no individuals of the F_2 generation. This year two Leicester yearling ewes and a Rambouillet ram were purchased. Matings will be made with these two breeds. This cross should afford most interesting data especially in regard to wool characteristics, as the Leicester possessing one of the coarsest of fleeces and the Rambouillet the finest, such a combination should afford a most patent clew to the manner in which wool characters behave in heredity.

From the several different matings of parent stock we have obtained altogether one hundred individuals of the F_1 generation, forty-nine of which we shall be able to use for mating *inter se* this year to obtain the F_2 generation. The greatest number of F_1 individuals from any one cross has been gotten from that of the Hampshire and Rambouillet. In this respect the Southdown and Dorset cross comes next. It is with these crosses that the principal work in wool testing is being performed. The Southdown-Rambouillet cross, at least in numbers, has not proven very productive, most of the offspring as well being rams, which naturally minimizes the number of F_2 individuals we can obtain. The crosses of pure-bred rams upon native ewes has produced most excellent results. These native ewes are simply ordinary grade stock found all too prevalently in New Hampshire, that for generation after generation have been bred in a desultory fashion and represent a heterogeneous mixture of many of the pure-bred classes of sheep. They were chosen in the experiment mainly to prove the fact that it does not follow that what in a Mendelian sense is a pure character can exist only in the so-called pure-bred animals.

Many matings have also been made with pure-bred animals, and the inheritance of separate characteristics noted. We hope subsequently to be able to prove patently to breeders that in the improvement of pure-bred sheep they can make advantageous use of Mendel's law and that the law operates just as clearly in what is known as pure-bred types as where distinctly opposite characters are crossed.

Twenty-six characteristics have been distinguished and records of these are kept for each sheep. Diagrammatic drawings are made to indicate particular features, where a verbal description cannot adequately explain relative differences. For example, distribution of wool on head, ears and legs are described in this manner A special chart has been prepared for this purpose on which all the characteristics for each individual are associated and shown together.

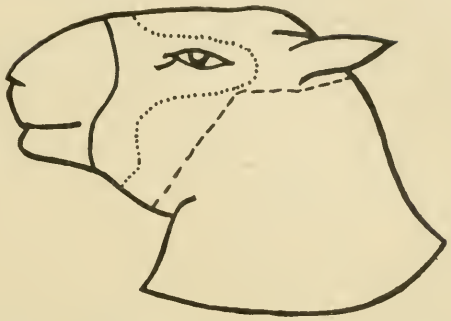
Color of pigment of skin and wool are indicated as to position on the body by a diagram and as to extent by a numerical percentage grade. All of these diagrams are so made that they can subsequently be reproduced in print Accurate measurements are taken of the length and circumference at base of horns, if present, the result being represented in a ratio of length to circumference. In fact, no measurement is taken of any part of the anatomy without comparing it in ratio with some other. It is the only means of being able to recognize, between animals, relative differences of many features.

Hair color has involved a very great amount of detailed study, owing to the fact that most of the parent native ewes were heterozygous in this respect in the first instance We anticipate, however, little difficulty in distinguishing its action in heredity, as it plainly follows the general rule, namely, dominance of the greater pigmentation over the lesser The F_1 heterozygotes produced from a cross between sheep, possessing respectively very dark and pure white hair color, usually present a mosaic appearance. However, in every instance there is a clear preponderance of the black color. It also appears from experimental evidence we have on hand that skin pigmentation in sheep is inherited in a similar fashion. This knowledge to sheep breeders should prove a decided boon, as the dark skin is a feature that shepherds greatly dislike and have long fought against.

The inheritance of horns, so far as the F_1 generation is concerned, from which we alone can judge, seems peculiar, although in harmony with T. B. Wood's sheep-breeding experiments (October, 1909, issue of the *Journal of Agricultural Science*). When a horned sheep is crossed upon a hornless,— it matters not which sex bears the horns,— all the male F_1 offspring are horned, while all the female F_1 offspring are hornless or virtually so. In no case are the horns of the F_1 rams so strong or large as those of the horned parent, although in every case they were much greater than what are commonly called scurs. Only about twenty per cent. of the F_1 ewes developed any appearance of horns and these were but slight, loose scurs. The explanation involves many complications, and we shall not dwell upon it at any great length in this report. The foregoing evidence shows that the inheritance of horns in sheep is apparently in some manner connected with sex. It is evident, however, that the horned condition is dominant; its absence, or the polled condition, recessive; but that in females something essential to the somatic development of horn is missing. It is possible that the production of horn depends upon a positive character or determiner + a material elaborated by the male germ glands and that in the absence of such material the horn fails to develop.

From a study of the F_1 offspring, distribution of wool, as applied especially to the face, ears and legs, seems to be inherited in a most simple fashion. When a sheep heavily wooled upon poll and face is crossed with one not wooled, the F_1 displays wooling on poll and face but in less degree than the most heavily wooled parent. This applies in similar fashion to distribution of wool on ears and legs. Therefore, from this evidence this theory may be declared; namely, the more extended or greater distribution of wool dominates over the less extended or sparser covering.

The following diagram clearly illustrates this feature:



Diagrammatic drawing showing the inheritance of wool covering on head: Wool covering of F_1 offspring is midway between that of both parents.

Data gathered from the F_1 generation tend to indicate that skin folding or wrinkling, which is a conspicuous character of the Merino type of sheep, is dominant over the non-folded or smooth skin of the medium and long-wooled breeds. A Merino crossed upon a non-wrinkled sheep always produced offspring exhibiting skin folds, although in no case were the wrinkles so heavy or so many as possessed by the Merino parent.

It is not necessary to elaborate here upon the inheritance of wool color. Our results correspond in every detail to those already worked out in this respect. Investigations have proved pretty clearly that the white wool is dominant over the black. We shall subsequently be able to show systematic records that will thoroughly establish this fact.

Wool testing employs exceeding and detailed labor. It is necessary that the component characteristics making up the entire fibre be separated and their action in heredity distinguished before a true idea anent wool inheritance can be formed. The length, crimp, tensile strength and elasticity of each separate wool fibre is obtained in one operation by means of a special machine built for that purpose. The crimp is approximated by getting the length of the fibre in its natural, crimped condition and the taut length and calculating in percentage the difference between the two.

One thousand fibres taken from the fleece of every sheep in, as nearly as can be determined, the same positions on the body are tested. Acknowledgment of assistance in this respect is due to the report of the wool specialist, eighteenth report of Wyoming Experiment Station. The average diameter and weight of the fibres of every fleece are also obtained. The percentage of yolk in a fleece is determined by the usual wool scouring method reduced

to laboratory conveniences. Only a small sample, twenty-five grams, taken from the shoulder is used. A sufficient number of records have not as yet been taken to permit the prediction of results.

Body measurements are mostly made by means of large calipers specially constructed for the purpose. These measurements are taken twice a year and regulated so as to have the ages of the sheep correspond in every instance. The system followed in making measurements and correlating the different parts in terms of a ratio can best be set forth in the following reproduction of part of the record blank used in the experiment for the original tabulation and description of characters:

NOSE			NECK			TRUNK				FORE LEG	
Sagittal lgh. to Horn Ridge.	Transverse diam. Skull at Poll.	Ratio T D / S L	Length: Horn Rdg. to 1st Thor. Vert.	Cir. Mid. between Horn Ridge and 1st Thor. Vert.	Ratio L / C	Length: 1st Thor. Vert. to Tail Head.	Dorsal Ventral dia. behind Fore Legs.	Tran. diam. behind Fore Legs.	Ratio T D / D V D	Length.	Ratio Leg L / Trunk L

HIND LEG		LEG BONES										
Length.	Ratio Leg L / Trunk L	Fore		Ratio Ulna / K to F	Hind		Ratio Tibia / K to F	Width of Loin.	Length of Croup: Apex of Ilium to Tail Head.	Ratio Loin / Croup	Hind Leg: Circum. as high as possible.	Ratio Tibia / Cir. H. Leg
		Ulna	Knee to Foot		Tibia	Knee to Foot						

Section of record chart, showing the system of taking and recording measurements.

The foregoing represents but a cursory review or outline of the manner of prosecuting this breeding experiment. Data showing complete results cannot be published until after obtaining of the F_2 generation next year.

(a) **Early Lamb Production.**

Owing to the fact that it was necessary to keep most of our largest ram lambs in 1910 for subsequent matings in the breeding experiment, only six "hot-house" lambs were dressed and sold and these not until April 14. These lambs represented two Dorset-Rambouillet crosses and one Dorset-Native cross, one Southdown-Rambouillet cross and two Shropshire-Native crosses.

Five of the lambs weighed between 28 and 30 pounds, dressing an average of 48.8 per cent. The price received was $9.00 a carcass. The sixth lamb,

a Shropshire-Native, weighed 50 pounds alive, dressing only 22 1-2 pounds or 45 per cent. Ready sale could not be found for this carcass which was sold even on a rising market for only $3.00. This clearly demonstrates that the Boston market at least does not want early lamb carcasses weighing less than 25 pounds, and from close observation of the market demands the writer can advisedly state that the highest prices always go to carcasses weighing between 28 and 30 pounds.

From our experience we have found that early lambs shrink in dressing from 50 to 55 per cent. and on an average about 52 per cent. Consequently, lambs should have a live weight of about 60 pounds before being sent to the shambles. It takes from ten to twelve weeks to get lambs to this weight. On the whole, thus far, the best results at this station in raising early lambs have been obtained by crosses of the Hampshire or Shropshire ram upon a Merino, Merino Grade or Dorset Horn ewe. The long-wool crosses have not proved nearly so satisfactory. Matings were made early in July this year, and it is hoped that many lambs will be dropped that can be killed and sold in February when the highest prices usually prevail.

(b) **Breeding Multi-nippled Sheep.**

Through the kindness of Dr. Alexander Graham Bell and Dr. C. B. Davenport, this station was presented this year with two multi-nippled sheep, a ram and ewe, each possessing seven apparent nipples. The ram has been mated with about forty ordinary two-nippled grade ewes. This should afford ample data for a thorough study of the inheritance of nipples.

(c) **Inheritance of Twins.**

At the present time sheep breeders, especially those catering to a fancy trade in pure-bred stock, prefer single lambs to twins. The reason for this is that few dams can be found that are able to nurse successfully two lambs. One good lamb that can be sold for a high price in the fall is better than two small, stunted lambs that must be kept through the winter and are sold the next spring or summer at a combined price, frequently little better than that received for one the season before.

With the advent of sheep possessing as many as four active nipples these conditions will change, for such a sheep is easily capable of producing sufficient milk for the support of two lambs. Naturally, then, since nothing occurs in nature in a hit-or-miss fashion, arose the possibility of being able to control the number of lambs at a birth. The principles underlying the inheritance of twins must, however, first be determined. Work in compiling data in this regard was begun last summer and will be pursued throughout the winter by means of circular letters to sheep raisers and a study of the many record books of breeders' associations.

(d) **Post-natal Variation in Growth.**

The frequency whereby we have considered it necessary to measure sheep in the breeding experiment in order to gain an average result has led us to study weekly the growth of lambs from birth, with the purpose in view of discovering the extent of variation, if any, in the growth of the different visible parts of the body.

Three lambs were selected at birth and accurate measurements, according to the system hitherto described, were taken weekly. This work is still in operation. Upon completion early this winter results will be published.

2. Sheep Feeding.

a. Clover hay *versus* New Hampshire native hay.

b. Value of turnips in the ration.

These experiments were carried on under the Hatch Fund. The feeding experiments pursued by this department during 1909–10 comprehend a series of actual feeding tests to discover the relative feeding values for sheep of clover hay and the ordinary hay mixture, designated native hay, that is, grown in New Hampshire, and coincidently to determine which renders the greatest economy in mutton production; also to discover the feeding value of turnips in conjunction with a ration of grain and hay.

In the clover and native hay feeding tests four lots of sheep were used, five in each lot. Two lots comprised lambs, the others being aged ewes. Both lots of lambs were fed an equal quantity of grain of a similar character and of roots. In addition one lot was given clover hay; the other an equal quantity of native hay. With the aged ewes the same plan was followed except that the hay composed the bulk of the ration, turnips only being fed besides. The value of turnips was tested by feeding grain and clover hay to one lot of sheep, while to the ration of another lot, made up of similar kinds of grain and hay, turnips were added. The grain and hay, however, given to the latter was reduced in quantity so as to make the two rations correspond as nearly as possible in total amount of dry matter and digestible protein, carbohydrates and fat.

These experiments were completed most satisfactorily in early summer. A bulletin will be issued directly, setting forth complete results. Consequently, it is not necessary to dwell in detail upon them in this report. Suffice it to say that it was clearly demonstrated by the results obtained that clover hay as a feed for sheep greatly excelled the native hay, producing greater gains in weight at considerably less cost. It was also proven that turnips in a ration were a boon, having a visible effect in decreasing the cost of mutton production.

The following table is self-explanatory and reveals in concise form the salient results of the experiment:

AVERAGE WEIGHT AND COST OF FEED FOR 100 POUNDS INCREASE IN WEIGHT.

Experiment	Lot	Grain lbs.	Turnips lbs.	Native Hay lbs.	Clover Hay lbs.	Total
Dry Ration	1	344	.....	.....	688	$11.96
v.						
Turnips	2	198	1,322	.....	330	9.60
Clover hay	3	142	569	.....	427	7.66
v.						
Native hay	4	218	873	655	.....	12.40
Clover hay	5	.....	2,173	.....	1,086	16.24
v.						
Native hay	6	.....	6,152	3,076	.....	42.87

3. Tobacco Feeding for the Eradication of the Stomach Worm in Sheep (Haemonchus contortus).

For years all manners of remedies have been tried for the prevention and destruction of the stomach worm in sheep. Some have proven fairly successful; others, even after a long period of general use, have been discarded as ineffectual or, if effective, difficult to administer satisfactorily. Within recent years the feeding of tobacco for this purpose has gained high favor with many shepherds. However, little evidence, emanating from systematic experimental work and setting forth the vermifugal qualities of tobacco when the crude unaltered product is fed, has thus far been recorded. By actual feeding tests this station hopes to discover the true merits of tobacco in this regard. The experiment was commenced last summer.

The main source of tobacco is the stems or midribs that are taken from the leaves when cigars are made. These can be bought from any cigar manufacturer at an exceedingly low price, usually about half a cent a pound. Several different methods have been tried of placing the tobacco before the sheep, so that they will eat abundant quantities of it at will. Results so far show that they take to it most readily when the material is dipped in salty water. This is kept constantly before the sheep. They receive no other salt. The sheep become very fond of it and will eat large quantities. No injurious effect has as yet been observed upon the sheep. For the experiment aged ewes and lambs, showing every indication of being badly infested with stomach worms, were purchased. The test will be continued for a year or more, until some satisfactory result can be attained.

Extension.

The animal husbandman and his assistant delivered a number of lectures on livestock topics at grange and other farmers' meetings during the past year. These lectures represent a most popular means of bringing before farmers instruction in up-to-date agricultural methods. Extensive growth in the correspondence handled by this department last year has been a source of keen satisfaction. Letters of inquiry have been received and answered upon almost every phase of the livestock industry. Moreover, this department is at all times willing to give assistance to farmers seeking information upon the feeding, management and diseases of all classes of animals and poultry.

REPORT OF THE DEPARTMENT OF ENTOMOLOGY.

W. C. O'KANE.

The work of this department for the biennial period ending October 30, 1910, falls into three groups, as follows:

1. Major investigations. These are exhaustive studies, carried on under the Adams Fund, and are undertaken with the purpose of conducting extended experiments that shall cover all aspects of the subject involved

The subjects chosen for these investigations are such as promise far-reaching and important data, both from the scientific and from the practical viewpoint. The experiments necessarily may extend over two or more seasons, and it is important that the work be carefully planned and that it be conducted without interruption and with adherence to a well-defined program.

Two such investigations have been under way in this biennial period,— an investigation of the Apple Maggot, *Rhagoletis pomonella*, Walsh; and a study of the influence of temperature on insect hibernations and transformations. Each of these is summarized below.

2. Minor investigations. Usually these are suggested by important insect outbreaks, as, for example, that of the Antlered Maple Worm in the hardwood forests of this state in 1907, 1908 and 1909. They are carried on under the Hatch Fund. Investigations of this nature are not planned on so exhaustive a scale as those in the first group mentioned above, and usually are concluded within one or two seasons.

Two investigations of this nature have been made within the last biennial period,— a study of the Oblique-banded Leaf-roller, *Archips rosaceana*, Harris; and experiments in the control of the Black Flies, or Buffalo Gnats, *Simulium* sp. These are briefly summarized below.

3. Miscellaneous work. This includes the identification of numerous specimens of insects sent in by correspondents, the recommendation of means of control for insect pests, and kindred duties.

Organization and Equipment.

Changes in the personnel of the department are elsewhere noted.

The new insectary, or outdoor laboratory, is the most notable addition to the equipment, and has proved of the greatest usefulness in the work of the department. Many experiments and studies could not be carried on satisfactorily without it. The insectary was pictured and described in detail in Scientific Contributions No. 3 of this station.

Additional items of equipment are needed from time to time in the major investigations. These have been provided.

Correspondence.

A constantly increasing number of citizens, both farmers and city dwellers, are learning to make use of this department. Many insects are sent in for identification, and many requests forwarded for instruction as to means of avoiding or controlling insect injury. The writer believes that these requests are of much value in bringing about closer relations between the station and the people of the state, and in affording this department an opportunity for immediate, practical usefulness.

To assist in this work and to supplement the department letters, the writer respectfully recommends that a series of uniform leaflets be issued on the commoner insect pests. It is believed that one sheet for each would be sufficient, that the subject-matter should be plain and concise, and that explanatory illustrations should invariably be used. It is further suggested that these leaflets be punched in the margin, so that they may be inserted in a loose-leaf binder, the complete file, therefore, being the equivalent of a com-

pact, working hand-book on insect pests. With this arrangement, any important change in the means of control of a given insect could be followed by the issuance of a new sheet which would take the place of the one formerly in use.

It is important that the correspondence of this department be thoroughly cross-indexed, and that adequate records be kept of specimens sent in for identification. For this work additional assistance is needed.

Publications of this Department.

Publications by this department in the current biennial period were as follows:

Bulletin 143, New Hampshire Experiment Station, December 1909, pp. 48, Fig. 29; "The Codling Moth and How to Control it by Spraying," by E. D. Sanderson

This bulletin gives in popular form the practical results of the investigation of 1907 and 1908 published in detail in the nineteenth and twentieth reports There are many calls throughout the state for the information contained in this bulletin

Scientific Contributions No. 3, New Hampshire Experiment Station, 1909, pp. 16, plates 5; I. "The Oblique-banded Leaf-roller," by E. D. Sanderson and A. D. Jackson; II. "A New Insectary," by E. D. Sanderson.

The first of these gives in detail the results of an investigation of an insect outbreak at Madbury, N. H.

The second describes and pictures the new insectary of this department. (Reprinted from the *Journal of Economic Entomology*, Vol. II, December, 1909.)

Scientific Contributions No. 4, New Hampshire Experiment Station, 1910, pp. 28, Fig. 21; "The Relation of Temperature to the Growth of Insects," by E. D. Sanderson

A discussion of some of the data obtained in experimental work conducted by this department, as a part of the investigation of the relation of temperature to insect growth and hibernation. (Reprinted from the *Journal of Economic Entomology*, Vol. III, April, 1910.)

Other Publications.

By W. C. O'Kane:

"Work on the Apple Maggot," *Journal of Economic Entomology*, Vol. III, April, 1910, pp. 169–172. An outline of the investigation planned and in progress at this station.

"Beating the Railroad Worm," *The New England Homestead* August 13, 1910, pp. 1, Fig. 2. A popular account of the life history of this pest and recommendations as to means of control.

"Spray Formulas in Terms of Kitchen Utensils," *The Garden Magazine*, June, 1910, pp. 294–296, Fig. 10. Directions for the preparation of spray materials in small amounts suitable for the garden or for limited areas.

"The Ohio Powdery Mildews," *The Ohio Naturalist*, Vol. X, No. 7, May, 1910, pp. 166–176, pl. 2. Technical descriptions and lists of food plants of the twenty-four species of powdery mildews known to exist in Ohio.

Demonstration Work.

In the summer of 1909 coöperative demonstration experiments were conducted at several points in the state.

In each case a representative of the station had immediate charge of the spraying. The station furnished the apparatus and materials.

Records were kept by most of the growers where such spraying was done, and from these the benefit or profit of the spraying was estimated. The results were uniformly gratifying, and it is believed that such demonstrations are of much practical value.

Some of the details of this work are recorded in Bulletin 143, pp. 93–96.

INVESTIGATIONS UNDER THE ADAMS FUND.

The Apple Maggot.

The principal investigation of the current year has been a study of the Apple Maggot, *Rhagoletis pomonella*, Walsh; or, as often designated, the Railroad Worm. To this work the station entomologist has given the greater part of his time. In addition a student assistant was employed for several hours each day through the spring months, and two student assistants were employed continuously throughout the summer.

To carry on the work to better advantage two field stations were established. One of these, near Barrington post office, was maintained during the early part of the summer Later a new station was chosen, about three miles distant, and the student assistant who had been at work at the first station was transferred to the second. The maintenance of these stations greatly assisted in the work, since only in this way could the conditions be secured that were necessary for some of the experiments.

Gratifying progress has been made in this investigation. It is believed that the knowledge of this pest acquired this summer will be of practical value in formulating means of control.

A part of the experimental work is practically complete, and in this the data on hand are extensive enough to warrant definite conclusions. These experiments do not need to be repeated.

Another part of the work was along new and untried lines. In this the results need verification and amplification, and it is highly desirable that further experiments be carried on throughout next season. The nature of this part of the work will be indicated below. Again, certain new and important lines of investigation have been suggested by various features of this year's work, and these should receive attention next year.

For each of the above, careful preparations have been made, and the proposed work is already blocked out.

A brief summary of the results secured to date is as follows:

A study of the amount of damage done by the Apple Maggot disclosed the fact that fully 95 per cent. of the orchards of the state are more or less infested.

Certain varieties are especially susceptible to attack. Others are infested only occasionally. One or two varieties are practically immune. Studies were made of seventy-one varieties of apple in this regard.

A series of experiments were conducted to determine whether fruit of a given variety infested with the maggot would deteriorate any more quickly in cold storage than other fruit of the same variety not so infested. It was found that as a rule the deterioration is more rapid in the case of infested fruit.

Throughout July and August studies were made to determine the extent of the egg-laying season. It was found that the first eggs are laid soon after the flies begin to emerge, about July 2 to 5, and that egg laying continues through July and August, and probably into September. This is true regardless of variety, except, of course, that eggs are not laid in early apples after they have ripened and dropped from the tree.

In determining these points trees of several varieties were selected in localities where flies had been observed the previous season. Clusters of fruit were enclosed in cheesecloth bags prior to the beginning of the egg-laying season. Certain clusters were then exposed to infestation each week, the bags being replaced at the end of the week. An examination of the ripe fruit at harvest time disclosed the total period of egg laying, and to some extent indicated the period of greatest activity.

Experiments were made to determine whether maggots may mature in winter fruit, such as the Baldwin. It was found that where such fruit becomes infested, the early drops, that is those falling in August, may easily become sufficiently mellow to permit the maggots to mature. On the other hand, badly infested Baldwins gathered early in October failed to mature a single maggot. The same was found to be true of Russets. It is the early drops, therefore, that should be disposed of, in the case of winter varieties.

The surest means of control for the Apple Maggot has always been the practice of keeping all drops picked up. There have been no records, however, which would indicate how often the dropped fruit should be gathered.

Experiments were arranged, therefore, to determine this point for ten typical varieties of apples. Trees were selected that bore abundant crops of infested fruit. All the drops under each tree were gathered once every twenty-four hours. These drops were then maintained under observation, and records kept showing when the maggots began issuing from them, when they issued in greatest numbers, and how long they continued to emerge.

It was found that in the case of such varieties as the August Sweet or the Early Harvest some maggots began to emerge within thirty-six hours, though they did not come out in large numbers until three or four days had elapsed since the apple fell from the tree. With varieties such as the Gravenstein a week elapsed before the maggots began issuing in any considerable numbers. In the case of winter fruit, such as the Westfield, practically no maggots emerged until after the apples had been off the tree from two to four weeks.

In practice, therefore, a grower may readily eliminate the pest from a given block of trees if he will arrange to keep all drops picked up at appropriate intervals. In the case of such early maturing fruit as the August Sweet it may be advisable to make use of livestock, such as swine, to care for the drops as they fall. Usually this can be done by erecting a temporary fence around the tree or trees that are infested, and enclosing one or more pigs within In the case of fall fruit it will suffice if all drops are cleaned up twice a week. With winter fruit once in two weeks will suffice.

There is nothing to indicate, so far, that the adult flies normally travel any great distance. All data on hand tend to indicate that the flies are rather sluggish and are apt to remain near the place where they emerged.

It has been proposed at various times to eliminate the Railroad Worm from a given block of trees by plowing the pupæ under in the spring, the idea being to bury them so deep that the flies could not make their way to the surface of the ground.

Some experiments performed at the Rhode Island station indicated that this plan was not feasible. Further experiments the past season at this station corroborate the results in Rhode Island, and warrant the statement that it is out of the question to bury the pupæ so deep by plowing that the flies will be unable to reach the surface.

Certain experiments in spraying were undertaken this season. The principle involved was that of poisoning the adult fly by the use of a mixture of arsenic, molasses and water distributed over the leaves of the tree by means of a common spray pump. This plan has been followed successfully in the case of similar insects occurring in other countries.

Through the coöperation of growers this plan of spraying was tried at several different points. In most the results were negative. It seems probable that in these instances the possible value of the treatment was obscured by the proximity of other infested trees not so treated. Also owing to the pressure of other work the grower was unable to apply the spray as often as would be needed in order to keep the poisoned sweet ready for the flies throughout their egg-laying season. In one instance, however, the treated tree stood alone, and this tree was given repeated sprayings as primarily planned. The variety was August Sweet and the fruit had been worthless for years. This tree yielded this season practically perfect fruit.

There is sufficient reason, therefore, for making further tests of this treatment next season. To this end certain trees or blocks of trees have been selected, and the proper conditions provided to insure definite tests next season.

Certain details in the habits and life history of this insect are imperfectly known. These matters have been under study the past year, but another season's work will be needed.

There is a question, also, as to the possible existence of more than one species of this fly in the orchards of New Hampshire.

By way of summary, the past year's work has added materially to our knowledge of this insect, and it is believed that another season will bring to a close the major part of this investigation.

The Influence of Temperature on Insect Transformations and Hibernations.

For several years this department conducted an exhaustive investigation of the influence of temperature on insect transformations and hibernations. In all, many thousands or hundreds of thousands of insects were handled. An immense amount of data was secured which shed much interesting light on the laws and conditions governing and attending certain phases of insect growth and activity.

These experiments were under the immediate direction of Prof. E. D. Sanderson. They were brought to a close this past season.

A part of the data secured have already been summarized and published as Scientific Contributions 1 and 4 of this station.

INVESTIGATIONS UNDER THE HATCH FUND.

The Black Fly.

Experiments were conducted in the summer of 1909 looking toward some means of control of the black flies or "buffalo gnats" in the summer resort regions of New Hampshire, particularly in the White Mountains. The place chosen for this work was the town of Randolph, and the streams treated were the Moose River and some of its tributaries.

The treatment consisted of the application of a soluble oil known as "Phinotas Oil" to these streams. This oil, mixing readily with the water, came into contact with the larvæ of the black fly attached to stones under the surface of the water, and killed them.

The serious difficulty in this treatment lay in the possible injury to trout, but an experiment of the summer of 1909 seemed to indicate that this danger might be avoided by using nets stretched across the stream to turn the fish back and prevent them from descending the stream with the oil and thus remaining too long in it.

In May and June of the past year, 1910, further experiments were performed in the same streams. It was desired to establish definitely the dosage necessary to kill the black fly larvæ, and to determine whether the fish might be entirely protected from injury.

The experiment was successful. The proper dosage and duration of treatment were ascertained, and it was demonstrated that with proper precautions this treatment can be safely and economically applied. A section of stream was so treated, with the result that practically all larvæ were exterminated, and no fish were injured.

The Antlered Maple Worm.

In the summer of 1909 the so-called Antlered Maple Worm, *Heterocampa gutivitta*, was under observation and study by this department. A serious outbreak of this pest in 1908 had defoliated the hardwood through a large area of the state. The outbreak was repeated in 1909. The results of this department's investigations were published in full in the biennial report for 1906–08

The past season, 1910, witnessed an almost complete cessation of the abnormal numbers of this insect. Specimens were observed at various points, but they were not in sufficient numbers to cause injury or comment. In one area a fairly large number of the larvæ were observed, but when they were still small heavy storms washed them from the trees and apparently they did not regain their foothold.

The cause of the sudden reduction in numbers whether due to climatic conditions, natural enemies, bacterial disease or some other adverse circumstance is not known. However oscillations of this nature are not at all uncommon and in the case of this insect the sudden cessation noted was not surprising.

The Oblique-Banded Leaf-roller.

A serious outbreak of this insect occurred in the summer of 1909 in large greenhouses at Madbury, N. H. Thousands of rose plants were defoliated and the monetary damage done was large.

An investigation of this insect, its habits and possible means of control was at once started. Interesting and valuable data were secured. The futility of certain remedial measures was demonstrated and the value of other plans was determined.

The results are given in full in Scientific Contributions No. 3 of this station.

PUBLICATIONS OF THE NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION 1888–1908

Bulletin. BULLETINS.

No. *1. Ensilage. Whitcher, G. H. April, 1888. 16p.
No. 2. Feeding experiments, Whitcher, G. H. June, 1888. 14p.
No. 3. When to cut corn ensilage. Whitcher, G. H. July, 1888. 9p.
No. 4. The science and practice of stock feeding. Whitcher, G. H. November, 1888. 31p.
No. 5. Fertilizers and fertilizing materials. Whitcher, G. H. March, 1889. 18p.
No. 6. Experiments with fertilizers. Whitcher, G. H. April, 1889. 32p.
No. *7. Tests of dairy apparatus. Whitcher, G. H. March, 1889. 16p.
No. 8. Feeding experiments. Whitcher, G. H. November 1889. 17p.
No. 9. Effect of food upon milk. Whitcher, G. H. February, 1890. 16p.
No. *10. Coöperative fertilizer experiments. Whitcher, G. H. March, 1890. 16p.
No. *11. Pig-feeding experiments. Whitcher, G. H. November, 1890. 14p.
No. 12. Fertilizer experiments. Whitcher, G. H. March, 1891. 13p.
No. *13. Effect of food on butter. Wood, A. H., and Parsons, C. L. May, 1891. 11p.
No. 14. Ensilage in dairy farming. Whitcher, G. H. May 1891. 8p.
No. *15. Patent cattle-foods. Whitcher, G. H., and Morse, F. W. December, 1891. 7p.
No. 16. Effect of food on composition of butter fat. Morse, F. W. September, 1892. 20p.
No. 17. Stock feeders' guide. Whitcher, G. H. October, 1892. 13p.
No. *18. Effect of food on milk. Wood, A. H. November, 1892. 16p.
No. 19. Spraying apples and pears against fungi. Lamson, H. H. February, 1894. 13p.
No. 20. Effect of food on milk. Wood, A. H. March, 1894. 8p.
No. 21. Farm yard manures and artificial fertilizers. Whitcher, G. H. April, 1894. 16p.
No. 22. Prevention of potato blight. Lamson, H. H. May, 1894. 8p.
No. *23. Some dangerous fruit insects. Weed, C. M. November, 1894. 22p.
No. 24. Flow of maple sap. Wood, A. H. February, 1895. 9p.
No. 25. The composition of maple sap. Morse, F. W., and Wood, A. H. March, 1896. 13p.
No. 26. Analysis of fertilizers and wood ashes. Morse, F. W. March, 1895. 10p.
No. *27. Spraying experiments in 1894. Lamson, H. H. April, 1895. 16p.
No. 28. Remedies for the horn fly. Weed, C. M. June, 1895. 4p.
No. *29. Remedies for the flea beetle. Weed, C. M. June, 1895. 7p.
No. 30. An experiment in road making. Pettee, C. H. July, 1895. 19p.
No. 31. Seventh annual report. Murkland, Charles S. November, 1895. 24p.
No. 32. Studies of maple sap. Morse, F. W. September, 1895. 16p.
No. 33. Two shade tree pests. Weed, C. M. November, 1895. 9p.
No. 34. Surface and sub-irrigation out of doors. Rane, F. W. August, 1896. 27p.
No. *35. The codling moth and apple maggot. Weed, C. M. May, 1896. 6p.
No. 36. Analysis of three common insecticides. Morse, F. W. June, 1896. 4p.
No. 37. Crimson clover. Rane, F. W. July, 1896. 4p.
No. *38. The tent caterpillar. Weed, C. M. August, 1896. 15p.
No. 39. The army worm. Weed, C. M. September, 1896. 13p.
No. 40. Eighth annual report. Murkland, C. S. November, 1896. 16p.
No. *41. Potatoes; varieties, fertilizers and scab. Rane, F. W., and Hunt, Leigh. February, 1897. 10p.
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No. 46. Experiments with a steam drill and methods of road maintenance. August, 1897. 29p.
No. *47. Strawberries in New Hampshire. Rane, F. W. October, 1897. 26p.
No. *48. Ninth annual report. Murkland, C. S. November, 1897. 30p.
No. *49. The inspection of fertilizers in 1897. Morse, F. W. January, 1898. 18p.
No. *50. Dehorning cattle. Lamson, H. H., and Rane, F. W. February, 1898. 9p.

*Out of print.

Bulletin. BULLETINS.

No. *51. Sweet corn in New Hampshire. Rane, F. W. March, 1898. 15p.
No. *52. Growing muskmelons in the North. Rane, F. W. April, 1898. 24p.
No. *53. The farm water supply. Morse, F. W. May, 1898. 11p.
No. *54. The winter food of the chickadee. Weed, C. M. June, 1898. 15p.
No. *55. The feeding habits of the chipping sparrow. Weed, C. M. July, 1898. 10p.
No. *56. Poisonous properties of wild cherry leaves. Howard, C. D., and Morse, F. W. August, 1898. 10p.
No. *57. Experiments with roots and forage crops. Rane, F. W. September, 1898. 28p.
No. *58. Cost of raising calves. Morse, F. W. October, 1898. 8p.
No. *59. Tenth annual report. Murkland, C. S. November, 1898. 53p.
No. *60. Green corn under glass. Rane, F. W. January, 1899. 16p.
No. *61. Inspection of fertilizers in 1898. Morse, F. W. February, 1899. 11p.
No. *62. Forcing pole beans under glass. Rane, F. W. February, 1899. 7p.
No. *63. Third potato report. Rane, F. W. March, 1899. 37p.
No. 64. Forest tent caterpillar. Weed, C. M. April, 1899. 22p.
No. *65. Notes on apple and potato diseases. Lamson, H. H. May, 1899. 10p.
No. 66. Experiments in pig feeding. Burkett, Charles W. September, 1899. 15p.
No. 67. Spiny elm caterpillar. Weed, C. M. October, 1899. 15p. il.
No. 68. Eleventh annual report. Markland, C. S. November, 1899. 49p.
No. 69. Inspection of fertilizers, in 1899 in cooperation with the State Board of Agriculture. Morse, F. W. January, 1900. 14p.
No. *70. Experiments with muskmelons. Rane, F. W. January, 1900. 27p.
No. 71. Corn culture. Burkett, C. W. February, 1900. 12p.
No. 72. Insect record for 1899. Weed, C. M. February, 1900. 14p.
No. *73. Experiments with tomatoes and potatoes. Rane, F. W. March, 1900. 11p.
No. 74. Growing strawberries in New Hampshire. Rane, F. W. April, 1900. 20p.
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No. 76. Utilizing the greenhouse in summer. Rane, F. W. June, 1900. 10p.
No. 77. Experiments in road surfacing. Pettee, C. H. September, 1900. 15p.
No. 78. Bovine tuberculosis. Lamson, H. H. October, 1900. 17p.
No. 79. Twelfth annual report. Markland, C. S. Nov. 1900. 38p.
No. 80. Inspection of fertilizers in 1900. Morse, F. W. January, 1901. 8p.
No. *81. Insect record for 1900. Weed, C. M. February, 1901. 12p.
No. *82. Feeding farm horses. Burkett, C. W. July, 1901. 25p.
No. 83. The value of meadow muck. Morse, F. W. August, 1901. 4p.
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No. 88. Inspection of fertilizers in 1901. Morse, F. W. January, 1902. 11p.
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No. 90. Insect record for 1901. Weed, C. M. March, 1902. 16p.
No. 91. Killing woodchucks with carbon bisulphide. Weed, C. M. May, 1902. 4p.
No. 92. Silage studies. Morse, F. W. September, 1902. 14p.
No. 93. The cold storage of apples. Morse, F. W., and others. October, 1902. 25p.
No. 94. Remedies for fleas. Conradi, A. F. October, 1902. 4p.
No. *95. How to grow a forest from seed. Rane, F. W. November, 1902. 14p.
No. 96. Fourteenth annual report. Murkland, C. S. November, 1902. 31p.
No. *97. Inspection of fertilizers in 1902. Morse, F. W. January, 1903. 12p.
No. *98. The inspections if feeding stuffs for 1902. Morse, F. W. February, 1903. 23p.
No. 99. A selected list of vegetables for the garden. Rane, F. W. March, 1903. 18p.
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No. 101. Fungous diseases and spraying. Lamson, H. H. April, 1903. 12p.
No. 102. Insect record for 1902. Weed, C. M. May, 1903. 10p.
No. 103. Standard milk. Morse, F. W. October, 1903. 4p.
No. 104. Fifteenth Annual Report. November, 1903. 15p.
No. 105. Fruit growing with a selected list of varieties. Rane, F. W. January, 1904. 24p.
No. *106. Forestry. Rane, F. W. February, 1904. 16p.
No. *107. Brown-tail moth in New Hampshire. Weed, C. M. February, 1904. 15p.
No. 108. Inspection of fertilizers in 1903. Morse, F. W. March, 1904. 10p.
No. 109. The pernicious or San Jose scale insect in New Hampshire. Weed, C. M. March, 1904. 10p.
No. 110. Experiment in orchard management in New England. Rane, F. W. March, 1904. 21p.
No. 111. Ten experiments with potatoes and potato culture. Rane, F. W., and Hall, H. F. April, 1904. 23p.
No. 112. Experiments in destroying black-flies. Weed, C. M. May, 1904. 8p.
No. 113. Corn meal middlings and separator skim-milk for fattening pigs. October, 1904. 7p.
No. 114. Babcock test for New Hampshire farmers. Weld, I. C. November, 1904. 13p.
No. *115. Sixteenth annual report. December, 1904. 19p.
No. 116. The inspection of feeding stuffs. Morse, F. W. January, 1905. 8p.
No. 117. Inspection of fertilizers in 1904. Morse, F. W. January, 1905. 8p.
No. 118. Tile drainage. Taylor, F. W. March, 1905. 32p.
No. 119. Forestry. Rane, F. W. March, 1905. 20p.
No. 120. Dairy industry in New Hampshire. Weld, I. C. September, 1905. 10p.
No. 121. Gypsy moth. Sanderson, E. D. December, 1905. 22p.
No. *122. Brown-tail moth in New Hampshire. Sanderson, E. D. February, 1906. 28p.
No. *123. Inspection of fertilizers in 1905. Morse, F. W. February, 1906. 8p.
No. *124. Inspection of feeding stuffs in 1905. Morse, F. W. March, 1906. 8p.

*Out of print.

Bulletin.

BULLETINS.

No. 125. Vegetable novelties. Rane, F. W., and Hall, H. F. March, 1906. 28p.
No. 126. The care of composite milk samples. Weld, I. C. April, 1905. 4p.
No. 127. The feeding of farm stock. Taylor, F. W. September, 1906. 24p.
No. *128. Brown-tail and gypsy moth. Sanderson, E. D., and Howard, L. O. January, 1907. 22p.
No. 129. The seventeenth and eighteenth annual reports. January, 1907. 44p.
No. *130. Inspection of fertilizers. Morse, F. W. February, 1907. 8p.
No. 131. Spraying the apple orchard. Sanderson, E. D., and others. April, 1907. 48p.
No. 132. A plan for improving the quality of milk and cream furnished to New Hampshire creameries. Weld, I. C. May, 1907. 11p.
No. 133. Inspection of feeding stuffs in 1907. Morse, F. W. November, 1907. 8p.
No. *134. Fertilizer analyses, 1907. Morse, F. W., and Curry, Bert E. December, 1907. 8p.
No. 135. The respiration of apples and its relation to their keeping. Morse, F. W. February, 1908. 8p.
No. 136. Gypsy and brown-tail moths. Sanderson, E. D. February, 1908. 63p.
No. 137. Strawberries for New Hampshire. Hall, H. F. May, 1908. 36p.
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No. 139. Caterpillars injuring apple foliage in late summer. Sanderson, E. D. July, 1908. 22p.
No. 140. Analyses of feeding stuffs and fertilizers. Morse, F. W., and Curry, B. E. December, 1908. 16p.
No. 141. A study of farm buttermaking in New Hampshire. Rasmussen, Fred. September, 1909. 36p.
No. 142. The availability of the soil potash in clay and clay loam soils. Morse, F. W., and Curry, B. E. December, 1909. 22p.
No. 143. The codling moth and how to control it by spraying. Sanderson, E. D. December, 1909. 48p.
No. 144. Some apple diseases. Brooks, Charles. December, 1909. 32p.
No. 145. Variety tests of oats, barley, wheat and rye. Taylor, F. W. December, 1909. 16p.
No. 146. Analyses of fertilizers. Curry, B. E. December, 1909. 12p.
No. 147. Analyses of feeding stuffs. Morse, F. W., and Curry, B. E. December, 1909. 20p.
No. 148. Results of seed tests for 1910. Taylor, F. W. September, 1910. 24p.
No. 149. Results of the feed inspection for 1910. Curry, B. E., and Smith, T. O. October, 1910. 12p.

ANNUAL REPORTS.

†First Annual Report 1889. In the Eighteenth Report of the Board of Trustees of the New Hampshire College of Agriculture and Mechanic Arts. 1889. 99p.
†Second Annual Report 1890. In the Nineteenth Report of the Board of Trustees of the New Hampshire College of Agriculture and Mechanic Arts. 1890. p. 77–122.
Third and Fourth Annual Reports 1891–1892. In the Twentieth Report of Board of Trustees of the New Hampshire College of Agriculture and Mechanic Arts. 1893. p. 137–287.
Fifth Annual Report 1893. In the Twenty-first Report of the Board of Trustees of New Hampshire College of Agriculture and Mechanic Arts. 1893. p. 85–241.
Sixth Annual Report 1894. In the Twenty-second Report of the Board of Trustees of New Hampshire College of Agriculture and Mechanic Arts. 1894. p. 118–173.
All subsequent reports of the Station appear as Bulletins. See Bulletin list.
Nineteenth and Twentieth Reports. In the Twenty-ninth Report of the Board of Trustees of New Hampshire College of Agriculture and Mechanic Arts. 1908. p. 246–680.

TECHNICAL BULLETINS.

No. 1. An annotated catalogue of the butterflies of New Hampshire. Fiske, W. F. 1901. 80p.
No. *2. Classification of American muskmelons. Rane, F. W. March, 1901. 32p.
No. 3. Food of the myrtle warbler. Weed, C. M., and Dearborn, Ned. November, 1901. 32p.
No. *4. Effect of acetylene gas-light on plant growth. Rane, F. W. October, 1902.
No. 5. A partial bibliography of the economic relations of the North American birds. Weed, C. M. 41p.
No. 6. A study of the parasites of the American tent caterpillar. Fiske, W. F. 1903. 58p.

NATURE STUDY LEAFLETS.

No. 1. Pollination of flowers. Weed, C. M. 1902. 12p.
No. 2. Mission of the birds. Weed, C. M. 1902. 8p.
No. 3. Plant travelers. Weed, C. M. 1902. 8p.
No. *4. New Hampshire wild flowers. Weed, C. M. 1903. 16p.

SCHOOL BULLETINS.

No. 1. Agricultural education through rural schools. Sanderson, E. D. 1908. 20p.
No. 2. Soil studies. Taylor, F. W. 1908. 22p.
No. 3. Seeds and seedlings. Brooks, C. 1908. 14p.

CIRCULARS.

No. 1. Mixing chemical fertilizers on the farm. Morse, F. W. 1908. 4p.
No. 2. Testing soils for fertilizer needs. Taylor, F. W. 1908.
No. 3. The apple leaf-aphis. Sanderson, E. D. 1908. 6p.
No. 4. Oyster-shell scale. 1908. 4p.
No. 5. San José scale. Sanderson, E. D. 1908. 12p.
No. 6. A circular of information concerning the New Hampshire Agricultural Experiment Station. 1908. 16p.
No. 7. Some essentials in farm butter-making. Rasmussen, F. 1908. 2p.
No. 8. The box pack for apples. Wicks, W. H. September, 1909. 8p.
No. 9. Alfalfa in New Hampshire. Taylor, F. W. June, 1910. 4p
No. 10. Breeding and selection of corn. Taylor, F. W. October, 1910. 8p.

*Out of print.
†Also published separately.

Meteorological Record: Month of July, 1908.

July, 1909.	Temperature.			Precipitation.						
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.	Prevailing wind direction.	Character of day.
1	84	50	34						S.	Clear
2	92	57	35	4 p. m.	6 p. m.	.028			E. S. E.	Partly cloudy
3	83	61	22	6.45 p. m.		.03			S. S. E.	Partly cloudy
4	82	62	20			.06			S. E.	Cloudy
5	90	67	23						S. S. W.	Partly cloudy
6	90	66	24						S. S. W.	Clear
7	93	65	28						S.	Clear
8	86	64	22						N. W.	Clear
9	82	51	31						S. E.	Clear
10	78	47	31						S. S. E.	Clear
11	92	52	40						S. W.	Clear
12	98	66	32						S. W.	Clear
13	91	68	23						W.	Clear
14	85	63	22						W.	Cloudy
15	78	62	16						N. W.	Partly cloudy
16	75	61	14						N. W.	Clear
17	80	43	37			.12			S. S. W.	Partly cloudy
18	90	59	31			.44			S. W.	Partly cloudy
19	79	61	18			.56			S. E.	Cloudy
20	78	60	18			.01			E. S. E.	Partly cloudy
21	76	54	22						S. S. E.	Clear
22	79	59	20			.93			S. S. E.	Partly cloudy
23	86	60	26			.01			E. N. E.	Partly cloudy
24	79	63	16			.24			E.	Partly cloudy
25	65	56	9			.46			E. S. E.	Cloudy
26	83	53	30			.02			W. S. W.	Clear
27	92	55	37						W. N. W.	Clear
28	79	58	21						E. N. E.	Cloudy
29	82	56	26						E.	Clear
30	92	60	32						E. S. E.	Clear
31	95	67	28						S. E.	Clear
Sum	2614	1826				3.16				
Mean	84 3	58.9								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 84.3; Mean minimum, 58.9; Mean, 71.6; Maximum, 98; Date, 12; Minimum, 47; Date, 10; Greatest daily range, 40.

Precipitation—Total, 3.16 inches; Greatest in 24 hours, .93; Date, 22.

Number of Days—With .01 inch or more precipitation, 12; Clear, 16; Partly cloudy, 10; Cloudy, 5.

Dates of—Thunderstorms, 2.

Meteorological Record: Month of August, 1908.

August, 1908.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	78	63	15						N. N. E.	Cloudy
2	81	60	21						N. N. W.	Clear
3	81	53	28						S. S. E.	Clear
4	73	56	17	10 a. m.	8.00 p. m.	.03			S. S. E.	Cloudy
5	72	62	10	3 a. m.		1.20			S. E.	Cloudy
6	86	64	22			2.30			W. N. W.	Cloudy
7	73	62	11			.21			W. S. W.	Cloudy
8	82	61	21						S. W.	Clear
9	79	52	27						S.	Clear
10	82	58	24						S. S. E.	Clear
11	84	60	24						S. S. E.	Cloudy
12	83	56	27			.21			S. E.	Cloudy
13	91	66	25	7 p. m.	8.30 p. m.	.07			S. W.	Clear
14	87	67	20						W. N. W.	Clear
15	80	64	16						N. W.	Clear
16	73	56	17						N. N. W.	Clear
17	63	54	9			.14			S. E.	Cloudy
18	77	62	15						N. W.	Clear
19	76	49	27						W. S. W.	Clear
20	70	51	19						N. W.	Clear
21	77	43	34						S. W.	Clear
22	71	53	18			.10			S. W.	Cloudy
23	76	60	16						N. W.	Clear
24	76	48	28						W. N. W.	Clear
25	76	44	32						N. N. W.	Clear
26	60	51	9			1.16			S. E.	Cloudy
27	65	51	14			.01			E. S. E.	Cloudy
28	64	46	18						E. S. E.	Clear
29	71	39	32						E. S. E.	Clear
30	83	42	41						E. S. E.	Clear
31	73	57	16						E. S. E.	Clear
Sum	2363	1710				5.43				
Mean	76.2	55.1								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 76.22; Mean minimum, 55.16; Mean, 65.69; Maximum, 91; Date, 13; Minimum, 39; Date, 29; Greatest daily range, 41.

Precipitation—Total, 5.43 inches; Greatest in 24 hours, 2.30; Date, 6.

Number of Days—With .01 inch or more precipitation, 10; Clear, 20; Partly cloudy, 0; Cloudy, 11.

Dates of Thunderstorms, 4, 6 and 11.

REMARKS.

Slight frost, 29.

Meteorological Record: Month of September, 1908.

September, 1908.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	83	46	37						S. S. E.	Clear
2	71	62	9						S. S. E.	Cloudy
3	66	53	13						N. W.	Partly Cloudy
4	76	44	32						N. W.	Clear
5	80	47	33						S. S. W.	Clear
6	66	57	9			.13			S. S. E.	Cloudy
7	70	58	12						N. W.	Clear
8	70	44	26						N. W.	Clear
9	81	37	44						W. S. W.	Clear
10	85	60	25						W.	Partly cloudy
11	86	63	23						W.	Partly cloudy
12	76	55	21						N. N. E.	Clear
13	80	47	33						E. S. E.	Clear
14	72	52	20						N. N. E.	Clear
15	67	41	26						N. E.	Clear
16	70	37	33						E. S. E.	Clear
17	82	56	26						N. N. E.	Clear
18	83	52	31						N. W.	Cloudy
19	75	51	24						N. W.	Clear
20	67	41	26						N. E.	Clear
21	76	39	37						W. S. W.	Clear
22	80	53	27						S. W.	Clear
23	82	41	41						S. W.	Clear
24	84	53	31			.26			S.	Clear
25	74	60	14						N. E.	Clear
26	84	48	36						S. E.	Clear
27	88	59	29						S. W.	Clear
28	70	57	13						S. E.	Partly cloudy
29	70	54	16	3.40 a. m.	5.15a. m.	.66			W. N. W.	Clear
30	60	34	26						S. E.	Clear
Sum	2274	1501				1.05				
Mean	75.8	50.0								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 75.8; Mean minimum, 50.0; Mean, 62.9; Maximum, 88; Date, 27; Minimum, 34; Date, 30; Greatest daily range, 44.

Precipitation—Total, 1.05 inches; Greatest in 24 hours, .66; Date, 29.

Number of Days—With .01 inch or more precipitation, 3; Clear, 23; Partly cloudy, 4; Cloudy, 3.

Dates of—Killing frost, 16, partial; Thunderstorms, 24, 29; Auroras, 30.

REMARKS.

Very smoky much of the time throughout the last three weeks.

Meteorological Record: Month of October, 1908.

October, 1908.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	60	35	25						S. E.	Clear
2	53	40	13			.46			N. W.	Clear
3	63	37	26						W. N. W.	Clear
4	58	34	24						W.	Clear
5	65	29	36						S.	Clear
6	64	31	33						S.	Clear
7	64	30	34						S.	Clear
8	73	46	27						S. W.	Clear
9	62	41	21						S. S. W.	Partly cloudy
10	58	40	18						S. E.	Partly cloudy
11	72	44	28			.49			W.	Partly cloudy
12	61	39	22						N. W.	Clear
13	63	22	41						W.	Clear
14	73	32	41						W. S. W.	Clear
15	74	38	36						N. W.	Clear
16	78	42	36						S.	Clear
17	83	47	36						S.	Clear
18	85	50	35						N. W.	Clear
19	68	45	23						N. E.	Clear
20	48	32	16						E. S. E	Clear
21	57	27	30						E. S. E.	Clear
22	65	27	38						E. S. E.	Clear
23	69	28	41						S. S. E.	Clear
24	68	37	31						S. S. E.	Clear
25	63	52	11						S. S. E.	Cloudy
26	56	49	7						S. E.	Cloudy
27	68	52	16			1.57			N. W.	Partly cloudy
28	57	41	16						E. N. E.	Cloudy
29	55	49	6						N. E.	Cloudy
30	52	36	16			1.14			N. W.	Partly cloudy
31	40	31	9						W.	Clear
Sum	1975	1183				3.66				
Mean	63.7	38.1								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 63.7; Mean minumum, 38.1; Mean, 50.9; Maximum, 85; Date, 18; Minimum, 22; Date, 13; Greatest daily range, 41.

Precipitation—Total, 3.66 inches; Greatest in 24 hours, 1.57; Date, 27.

Number of Days—With .01 inch or more precipitation, 4; Clear, 22; Partly cloudy, 5; Cloudy, 4.

Meteorological Record: Month of November, 1908.

November, 1908.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	35	28	7						N. W.	Clear
2	46	20	26						N. W.	Clear
3	54	31	23						W. S. W.	Clear
4	57	27	30						N. W.	Clear
5	37	20	17						W. N. W.	Clear
6	43	24	19						W. S. W.	Clear
7	47	35	12						W. S. W.	Clear
8	44	33	11						N. N. W.	Cloudy
9	47	26	21						W. N. W.	Cloudy
10	43	30	13			.16			W. N. W.	Cloudy
11	45	41	4			.14			N. E.	Cloudy
12	45	35	10						W.	Clear
13	40	29	11						W.	Clear
14	47	28	19						W. N. W.	Clear
15	39	28	11			.47			W.	Clear
16	42	19	23						S. W.	Clear
17	45	23	22						N. W.	Clear
18	32	24	8			.18	1.50	1.50	N. N. W.	Cloudy
19	36	16	20						N. N. W.	Clear
20	43	28	15			.38			N. W.	Clear
21	47	16	31						W. S. W.	Clear
22	58	24	34						W. S. W.	Clear
23	56	29	27						W. S. W.	Partly cloudy
24	65	30	35						S. W.	Clear
25	52	36	16			tr.			E.	Cloudy
26	58	37	21			.10			E.	Cloudy
27	58	45	13						W. N. W.	Clear
28	47	38	9						W.	Clear
29	49	37	12						W. N. W.	Clear
30	48	31	17						W.	Clear
Sum	1405	868				1.43				
Mean	46.8	28.9								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 46.8; Mean minimum, 28.9; Mean, 37.9; Maximum, 65; Date, 24; Minimum, 16; Date, 19 and 21; Greatest daily range, 35.

Precipitation—Total, 1.43 inches; Greatest in 24 hours, .47; Date, 15.

Snow—Total fall, 1.5 inches.

Number of Days—With .01 inch or more precipitation, 6; Clear, 21; Partly cloudy, 1; Cloudy, 8.

Meteorological Record: Month of December, 1908.

December, 1908.	Temperature.			Precipitation.						
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.	Prevailing wind direction.	Character of day.
1	64	37	27						W.	Clear
2	51	25	26						W. N. W.	Clear
3	25	12	13						W. N. W.	Clear
4	43	13	30			.04			W. N. W.	Clear
5	37	14	23						N. W.	Clear
6	22	2	20						N. W.	Clear
7	54	16	38			1.60			S. E.	Cloudy
8	38	24	14						W. N. W.	Clear
9	33	14	19						W. N. W.	Clear
10	27	10	17						N. W.	Clear
11	28	—3	25						N. W.	Cloudy
12	37	16	21			.83	7	7 inches	W. N. W.	Partly cloudy
13	31	14	17						W. N. W.	Clear
14	37	14	23						N. W.	Clear
15	48	26	22						N. W.	Clear
16	40	25	15						N. W.	Clear
17	29	15	14						N. W.	Cloudy
18	27	14	13			.40			N. W.	Cloudy
19	32	13	19						N. N. W.	Clear
20	36	18	18						N. W.	Partly cloudy
21	42	20	22						W. N. W.	Clear
22	30	14	16						W. N. W.	Clear
23	18	5	13						W. N. W.	Clear
24	26	—7	19						W. N. W.	Clear
25	41	14	27			.07			N. W.	Partly cloudy
26	42	25	17						N. W.	Clear
27	38	23	15						W.	Partly cloudy
28	37	28	9						N. W.	Clear
29	36	20	16						N. W.	Clear
30	30	13	17						N. W.	Cloudy
31	38	26	12			.33			N. W.	Partly cloudy
Sum	1117	503	.....			3.27	.....	.....	.....	.....
Mean	36.	16.1	.....			.....	.....	.....	.....	.....

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 36; Mean minimum, 16.1; Mean, 26.1; Maximum, 64; Date, 1; Minimum, —7; Date, 24; Greatest daily range, 38.

Precipitation—Total, 3.27 inches; Greatest in 24 hours, 1.60; Date, 7.

Snow—Total fall, 7 inches; on ground 15th, 6 inches; At end of month, 3 inches.

Number of days—With .01 inch or more precipitation, 6; Clear, 21; Partly cloudy, 5; Cloudy, 5.

Meteorological Record: Month of January, 1909.

January, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	34	11	23						N. W.	Clear
2	32	6	26						N. W.	Clear
3	38	13	25						N. W.	Clear
4	46	34	12			.18			N. W.	Partly cloudy
5	53	33	20			.30			N. W.	Cloudy
6	55	38	17						N. W.	Partly cloudy
7	40	8	32						N. W.	Clear
8	18	3	15						N. W	Clear
9	32	4	28						S. W.	Partly cloudy
10	36	26	10						S. W.	Clear
11	51	33	18						W. S. W.	Partly cloudy
12	47	17	30						N. W.	Clear
13	19	4	15						N. E.	Clear
14	22	6	16			.53	2½	3 inches	N. E.	Partly cloudy
15	43	17	26						N. W.	Partly cloudy
16	18	—0	18						N. W.	Clear
17	26	—0	26						N. N. E.	Cloudy
18	30	—0	30			.56			N. W.	Clear
19	33	15	18						N. W.	Cloudy
20	27	15	12						N. W.	Partly cloudy
21	46	10	36						N. W.	Clear
22	56	36	20						S. W.	Clear
23	45	31	14						W. S. W.	Partly cloudy
24	34	18	16						N. W.	Clear
25	38	33	5			.14			N. E.	Cloudy
26	28	20	8						N. W.	Cloudy
27	34	13	21						W. N. W.	Clear
28	32	11	21						N. W.	Clear
29	32	14	18						W. N. W.	Clear
30	28	15	13			.22	10	12½ in.	N.	Cloudy
31	26	10	16						N. W.	Clear
Sum	1099	494				1 93	12½			
Mean	35.4	15.9								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 35.4; Mean minimum, 15.9; Mean, 25.7; Maximum, 56; Date, 22; Minimum, 0; Date, 16, 17 and 18; Greatest daily range, 36.

Precipitation—Total, 1.93 inches; Greatest in 24 hours, .56; Date, 19.

Snow—Total fall, 12.5 inches; on ground 15th, 3 inches; At end of month, 12 inches.

Number of Days—With .01 inch or more precipitation, 6; Clear, 17; Partly cloudy, 8; Cloudy, 6.

Meteorological Record: Month of February, 1909.

February, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	17	—4	21						N. W.	Clear
2	31	—7	38						N. W.	Clear
3	24	—0	24						W. N. W.	Clear
4	32	—6	38						W. N. W.	Clear
5	56	9	47						N. W.	Clear
6	53	33	20			.01			S. W.	Cloudy
7	45	23	22						N. W.	Clear
8	42	21	21						N. N. W.	Clear
9	29	5	24						N. W.	Clear
10	41	17	24			1.41			N. N. E.	Cloudy
11	31	24	7						W.	Clear
12	40	13	27						N. W.	Clear
13	50	28	22						S. W.	Clear
14	47	20	27						E.	Partly cloudy
15	25	15	10			.52	1	5 inches	N. E.	Cloudy
16	26	15	11			.84			N. E.	Cloudy
17	28	14	14						W.	Clear
18	26	17	9						N. W.	Clear
19	33	11	22						N. W.	Cloudy
20	36	33	3			.80			S. S. W.	Cloudy
21	43	28	15						N. W.	Clear
22	43	18	25						N. N. W.	Clear
23	41	19	22						S. E.	Clear
24	39	33	6			.45			E. S. E.	Cloudy
25	39	15	24						W. N. W.	Clear
26	26	11	15						W. N. W.	Clear
27	39	18	21						W.	Clear
28	38	22	16						W. N. W.	Clear
Sum	1020	435.				4.03	1			
Mean	36.4	15.5								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 36.4; Mean minimum, 15.5; Mean, 26; Maximum, 56; Date, 5; Minimum, —7; Date, 2; Greatest daily range, 47.

Precipitation—Greatest in 24 hours, 1.41; Date, 10.

Snow—Total fall, 1 inch; on ground 15th, 5 inches; At end of month, traces.

Number of days—With .01 inch or more precipitation, 6; Clear, 20; Partly cloudy, 1; Cloudy, 7.

Dates of—Thunderstorms, 16; sleet, 16, 24.

REMARKS.

On 20th gauge was overturned by means unknown. Amount estimated by comparison with other localities.

Meteorological Record: Month of March, 1909.

March, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	33	9	24	.....	.....	.....	.....	.....	N. N. W.	Clear
2	47	23	24	.....	.....	.17	.....	.....	S.	Cloudy
3	42	22	20	.....	.....	.....	.....	.....	E. N. E.	Partly cloudy
4	30	18	12	.....	.....	.25	.....	.....	N. E.	Cloudy
5	33	21	12	.....	.....	.....	.....	.....	W. N. W.	Clear
6	37	14	23	.....	.....	.....	.....	.....	W. N. W.	Clear
7	43	14	29	.....	.....	.....	.....	.....	S. S. W.	Clear
8	38	27	11	.....	.....	.....	.....	.....	N. W.	Clear
9	38	15	23	.....	.....	.13	.....	.....	N. W.	Cloudy
10	37	29	8	.....	.....	.....	.....	.....	N.	Cloudy
11	42	33	9	.....	.....	.....	.....	.....	W. N. W.	Clear
12	37	25	12	.....	.....	.....	.....	.....	W.	Clear
13	43	24	19	.....	.....	.....	.....	.....	S. W.	Clear
14	43	24	19	.....	.....	.....	.....	.....	W. N. W.	Clear
15	38	26	12	.....	.....	.....	.....	.....	N. W.	Clear
16	39	15	24	.....	.....	.....	.....	.....	S.	Partly cloudy
17	39	23	16	.....	.....	.....	.....	.....	W. N. W.	Clear
18	37	24	13	.....	.....	.....	.....	.....	W. N. W.	Clear
19	42	26	16	.....	.....	.....	.....	.....	N. W.	Clear
20	38	28	10	.....	.....	.09	2	.....	N. W.	Cloudy
21	39	24	15	.....	.....	.....	.....	.....	N. W.	Clear
22	37	22	15	.....	.....	.....	.....	.....	N. N. W.	Clear
23	43	30	13	.....	.....	.....	.....	.....	N. W.	Clear
24	49	26	23	.....	.....	.....	.....	.....	E. S. E.	Clear
25	38	28	10	.....	.....	.70	.....	.....	E. S. E.	Cloudy
26	44	34	10	.....	.....	.....	.....	.....	S. W.	Partly cloudy
27	49	26	23	.....	.....	.....	.....	.....	S. W.	Clear
28	43	33	10	.....	.....	.....	.....	.....	N.	Clear
29	47	35	12	.....	.....	.....	.....	.....	W. N. W.	Clear
30	46	35	11	.....	.....	.....	.....	.....	W. N. W.	Clear
31	49	36	13	.....	.....	.....	.....	.....	N. W.	Clear
Sum	1260	769	.....	.....	.....	1.34	2	.....	.....	.....
Mean	40.6	24.8	.....	.....	.....	.....	.....	.....	.....	.....

† Including rain, hail, sleet and melted snow

MONTHLY SUMMARY.

Temperature—Mean maximum, 40.6; Mean minimum, 24.8; Mean, 32.7; Maximum, 49; Date, 24, 27, 31; Minimum, 9; Date, 1; Greatest daily range, 29.

Precipitation—Total, 1.34 inches; Greatest in 24 hours, .70; Date, 25–26.

Snow—Total fall, 2 inches; on ground 15th, 0 inches; At end of month, 0 inches.

Number of Days—With .01 inch or more precipitation, 5; Clear, 22; Partly cloudy, 3; Cloudy, 6.

Meteorological Record: Month of April, 1909.

April, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	44	32	12						N. W.	Clear
2	42	20	22						S. S. E.	Clear
3	38	30	8			.01			E. N. E.	Cloudy
4	47	30	17						S. S. E.	Clear
5	63	41	22						S. S. E.	Clear
6	73	39	34			.01			S. S. W.	Clear
7	67	48	19						S. S. W.	Clear
8	62	41	21						W. N. W.	Clear
9	45	29	16			.16			W. N. W.	Cloudy
10	42	32	10						N. W.	Clear
11	43	30	13						N. N. W.	Clear
12	59	18	41						N. W.	Clear
13	69	38	31						S. W.	Clear
14	63	51	12			.62			S. S. W.	Cloudy
15	57	37	20			1.26			N. E.	Cloudy
16	58	38	20						N. E.	Clear
17	53	35	18						S. S. E.	Clear
18	57	35	22						S. E.	Clear
19	56	36	20			.05			S. S. E.	Partly cloudy
20	57	39	18			.02			E. S. E.	Cloudy
21	47	34	13						S. E.	Clear
22	65	37	28			.43			S. E.	Partly cloudy
23	57	40	17						W. N. W.	Cloudy
24	51	35	16						N. W.	Clear
25	50	25	25			.01			N. N. W.	Cloudy
26	49	34	15						N. E.	Clear
27	48	24	24						N. E.	Partly cloudy
28	47	35	12			.70			S. E.	Cloudy
29	48	24	24						S. E.	Clear
30	37	34	3			.18			E. S. E.	Cloudy
Sum	1594	1021				3.45				
Mean	53.1	31.								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 53.1; Mean minimum, 31; Mean, 27.08; Maximum, 73; Date, 6; Minimum, 18 Date, 12; Greatest daily range, 41.

Precipitation—Total, 3.45 inches; Greatest in 24 hours, 1.26; Date, 15.

Number of Days—With .01 inch or more precipitation, 11; Clear, 18; Partly cloudy, 3; Cloudy, 9.

Dates of—Thunderstorms, 19.

Meteorological Record: Month of May, 1909.

May, 1909.	Temperature.			Precipitation.						
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.	Prevailing wind direction.	Character of day.
1	41	31	10			.16			E. N. E.	Cloudy
2	53	35	18						W.	Clear
3	62	35	27			.04			S. S. W.	Partly cloudy
4	66	44	22			.01			S. S. W.	Partly cloudy
5	57	34	23						S. S. W.	Partly cloudy
6	77	41	36						S. W.	Clear
7	62	41	21			.08			N. N. W.	Cloudy
8	65	40	25			.04			S. E.	Partly cloudy
9	51	34	17						S. E.	Clear
10	81	44	37			.02			S. S. W.	Partly cloudy
11	72	55	17			.13			N. W.	Partly cloudy
12	68	39	29						W. N. W.	Clear
13	76	45	31						N. W.	Clear
14	81	48	33						S. S. E.	Clear
15	73	50	23						S. E.	Clear
16	56	47	9			.23			E. N. E.	Cloudy
17	53	43	10			.10			E. N. E.	Cloudy
18	53	44	9			.01			S. E.	Cloudy
19	56	40	16						S. E.	Clear
20	57	43	14						S. S. E.	Clear
21	56	32	24						S. S. E.	Clear
22	50	41	9			.08			N. E.	Partly cloudy
23	61	40	21						S. E.	Clear
24	75	45	30						S. W.	Clear
25	63	43	20						N. N. E.	Clear
26	75	35	40						W. N. W.	Clear
27	75	44	31						S. W.	Partly cloudy
28	57	49	8			.71			S. E.	Cloudy
29	66	51	15			.02			N. E.	Cloudy
30	68	57	11						N. W.	Clear
31	76	55	21						N. W.	Clear
Sum	1932	1325				1.66				
Mean	63.9	42.7								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 63.9; Mean minimum, 42.7; Mean, 53.3; Maximum, 81; Date, 10, 14; Minimum, 31; date, 1; Greatest daily range, 40.

Precipitation—Total, 1.66 inches; Greatest in 24 hours, .71; Date, 28.

Number of Days—With .01 inch or more precipitation, 13; Clear, 16; Partly cloudy, 8; Cloudy, 7.

Dates of—Killing frost, 21, moderate.

REMARKS.

Growth slow throughout month; but no severe frost at any time.

Meteorological Record: Month of June, 1909.

June, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	72	43	29						N. N. E.	Clear
2	76	43	33						N. W.	Partly cloudy
3	86	51	35						W. S. W.	Clear
4	73	44	29						N. W.	Clear
5	60	52	8			.15			E. S. E.	Partly cloudy
6	72	45	27						N. E.	Clear
7	70	52	18						S. E.	Clear
8	66	48	18						N. N. E.	Clear
9	73	48	25						S. E.	Clear
10	57	40	17			.31			S. S. E.	Cloudy
11	77	48	29			.12			W. N. W.	Partly cloudy
12	84	53	31						W. N. W.	Clear
13	77	53	24			.01			S. W.	Partly cloudy
14	85	59	26			.44			S. S. W.	Cloudy
15	75	64	11						W. N. W.	Clear
16	81	44	37						S. W.	Clear
17	77	47	30			.83			S. S. W.	Partly cloudy
18	67	52	15						S. W.	Clear
19	71	41	30						W. S. W.	Clear
20	84	52	32						W.	Clear
21	89	65	23						W. S. W.	Clear
22	93	65	28						W.	Clear
23	90	68	22						S. W.	Clear
24	92	67	25						W. N. W.	Clear
25	94	65	29						W. N. W.	Clear
26	82	62	20						S. W.	Clear
27	83	60	23						N. W.	Clear
28	79	55	24			.60			S. S. E.	Partly cloudy
29	79	63	16						N. E.	Partly cloudy
30	68	48	20						N. E.	Clear
Sum	2332	1597				2.46				
Mean	77.7	53.2								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 77.7; Mean minimum, 53.2; Mean, 65.5; Maximum, 94; Date, 25; Minimum, 40; Date, 10; Greatest daily range, 35.

Precipitation—Total, 2.46 inches; Greatest in 24 hours, .83; date, 17.

Number of Days—With .01 inch or more precipitation, 7; Clear, 21; Partly cloudy, 7; Cloudy, 2.

Dates of—Thunderstorms, 28.

Meteorological Record: Month of July, 1909.

July, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	82	59	23						W. S. W.	Clear
2	73	60	13						S. W.	Clear
3	72	56	16			.71			S. S. E.	Cloudy
4	70	58	12						N. W.	Clear
5	74	47	27						N. W.	Clear
6	68	46	22			.27			W.	Cloudy
7	72	46	26						S. E.	Partly cloudy
8	77	47	30			.13			S. E.	Clear
9	77	46	31						S. S. E.	Clear
10	83	49	34						S. S. E.	Clear
11	84	55	29						S. S. W.	Clear
12	79	56	23						S. S. W.	Partly cloudy
13	92	65	27						S. W.	Partly cloudy
14	89	65	24						W. N. W.	Clear
15	86	58	28						W. N. W.	Partly cloudy
16	77	62	15			.15			S. S. E.	Cloudy
17	80	60	20						N. N. W.	Clear
18	84	53	31			.07			W.	Partly cloudy
19	72	50	22						N. W.	Clear
20	74	53	21						S. E.	Clear
21	73	54	19						E. N. E.	Partly cloudy
22	70	50	20						S. S. E.	Cloudy
23	65	58	7						S. S. E.	Cloudy
24	74	58	16			.22			S. E.	Cloudy
25	76	49	27						S. W.	Clear
26	88	52	36						W. N. W.	Clear
27	91	57	34						S. W.	Clear
28	94	62	32						S. W.	Clear
29	96	62	34						S. W.	Clear
30	94	70	24			.14			S. W.	Partly cloudy
31	85	61	24			.04			N. N. W.	Partly cloudy
Sum	2471	1724	.....	.....	.....	1.73	.....	.....	.....	.....
Mean	79.7	55.6	.....	.....	.....	.....	.....	.....	.....	.....

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 79.7; Mean minimum, 55.6; Mean, 67.6; Maximum, 96; Date, 29; Minimum, 46; Date, 6, 7 and 9; Greatest daily range, 36.

Precipitation—Total, 1.73 inches; Greatest in 24 hours, .71; Date, 3.

Number of Days—With .01 inch or more precipitation, 8; Clear, 17; Partly cloudy, 8; Cloudy, 6.

Dates of—Thunderstorms, 16 and 30.

Meteorological Record: Month of August, 1909.

August, 1909.	Temperature.			Precipitation.						
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.	Prevailing wind direction.	Character of day.
1	76	57	19						S. E.	Clear
2	79	48	31						E. S. E.	Clear
3	81	46	35						E. S. E.	Clear
4	78	47	31						S. E.	Clear
5	64	58	6			.80			E. N. E.	Cloudy
6	77	59	18			.14			S. E.	Cloudy
7	87	55	32						S. E.	Clear
8	94	61	33						W. N. W.	Clear
9	88	68	20						W. N. W.	Partly cloudy
10	79	69	10						N. W.	Partly cloudy
11	76	51	25						N. N. W.	Clear
12	83	46	37						N. N. W.	Clear
13	78	52	26						S.	Cloudy
14	75	50	25						S. S. E.	Clear
15	71	42	29						S. S. E.	Clear
16	65	51	14			.02			S. S. E.	Cloudy
17	63	54	9						S. S. E.	Cloudy
18	70	55	15			1.87			N. N. E.	Cloudy
19	83	61	22						N. N. E.	Partly cloudy
20	87	55	32						W.	Clear
21	78	56	22						W. N. W.	Clear
22	74	53	21						S. S. E.	Clear
23	82	49	33						W. N. W.	Clear
24	81	52	29						S. E.	Clear
25	93	53	40						S. E.	Clear
26	84	64	20						W.	Partly cloudy
27	74	50	24						W.	Clear
28	83	63	20						S. E.	Clear
29	80	52	28						S. E.	Cloudy
30	69	53	16						N. W.	Clear
31	67	35	32						N. W.	Clear
Sum	2419	1565	.....			2.83	.....	.....	.....	.....
Mean	78.03	50 5	.....			.....	.....	.....	.....	.....

†Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 78.03; Mean minimum, 50.5; Mean, 64.26; Maximum, 94; Date, 8; Minimum, 35; Date, 31; Greatest daily range, 40.

Precipitation—Total, 2.83 inches; Greatest in 24 hours, 1.87; Date, 18.

Number of Days—With .01 inch or more precipitation, 4; Clear, 20; Partly cloudy, 6; Cloudy, 5.

Meteorological Record: Month of September, 1909.

September, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	73	50	23			.09			S. S. E.	Cloudy
2	67	49	18						N. W.	Clear
3	83	44	39						W. N. W.	Clear
4	84	42	42						S.	Clear
5	75	56	19			.56			N. W.	Cloudy
6	72	53	19						N. W.	Clear
7	76	37	39						W.	Clear
8	73	48	25						N. N. W.	Clear
9	67	49	18						S.	Clear
10	62	47	15			.02			E. S. E.	Cloudy
11	77	55	22						E. S. E.	Clear
12	68	47	21						N. E.	Clear
13	73	34	39						E. S. E	Clear
14	76	50	26						S. S. W.	Partly cloudy
15	64	54	10			.03			S. E.	Partly cloudy
16	73	53	20						S. E.	Cloudy
17	78	53	25			.35			S. E.	Cloudy
18	73	50	23						E. S. E.	Clear
19	63	44	19						E. N. E.	Clear
20	67	30	37						E. S. E.	Clear
21	71	45	26						S. E.	Cloudy
22	67	49	18						S. E.	Partly cloudy
23	83	60	23						S. E.	Partly cloudy
24	73	58	15			.70			N. W.	Cloudy
25	67	53	14			.08			N. W.	Partly cloudy
26	56	50	6			.81			N. N. W.	Cloudy
27	67	53	14			.79			N. N. E.	Cloudy
28	67	56	11			.64			N. N. E.	Cloudy
29	72	46	26			.27			N. N. W.	Clear
30	74	37	37						S. S. W.	Clear
Sum	2139	1452				4.34				
Mean	71.3	48.4								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 71.3; Mean minimum, 48.4; Mean, 59.8; Maximum, 84; Date, 4; Minimum, 30; Date, 20; Greatest daily range, 42.

Precipitation—Total, 4.34 inches; Greatest in 24 hours, 81; Date, 26.

Number of Days—With .01 inch or more precipitation, 11; Clear, 15; Partly cloudy, 5; Cloudy, 10.

Meteorological Record: Month of October, 1909.

October, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	63	40	23						W. S. W.	Clear
2	62	46	16						W. S. W.	Clear
3	62	47	15						N. N. E.	Clear
4	65	50	15						N.	Clear
5	73	35	38						N. N. W.	Clear
6	73	45	28						W. N. W.	Clear
7	79	43	36						W. S. W.	Clear
8	81	45	36						S. W.	Clear
9	84	43	41						S. W.	Clear
10	83	47	36						S. W.	Clear
11	61	46	15			.04			S.	Cloudy
12	64	54	10			.45			S. E.	Cloudy
13	63	35	28						W. N. W.	Clear
14	63	32	31						N. W.	Clear
15	55	38	17						N. W.	Clear
16	55	32	23						W. N. W.	Cloudy
17	56	32	24						W. N. W.	Cloudy
18	56	36	20						W.	Partly cloudy
19	48	36	12						N. W.	Clear
20	54	23	31						W.	Clear
21	56	36	20			.56			N. E.	Cloudy
22	62	44	18						S. S. E.	Partly cloudy
23	55	40	15						N.	Cloudy
24	57	40	17			.84			N. W.	Cloudy
25	54	48	6						N.	Cloudy
26	57	33	24						W.	Clear
27	67	37	30						W.	Clear
28	60	40	20						W. N. W.	Partly cloudy
29	44	34	10						W. N. W.	Clear
30	46	30	16						W. N. W.	Clear
31	52	32	20						W.	Clear
Sum	1811	1219				1.89				
Mean	58.4	39.3								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 58.4; Mean minimum, 39.3; Mean, 48.8; Maximum, 84; Date, 9; Minimum, 23; Date, 20; Greatest daily range, 41.

Precipitation—Total, 1.89 inches; Greatest in 24 hours, .84; Date, 24.

Number of Days—With .01 inch or more precipitation, 4; Clear, 19; Partly cloudy, 3; Cloudy, 8.

Meteorological Record: Month of November, 1909.

November, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	52	27	25						W.	Clear
2	57	44	13						S. E.	Cloudy
3	61	45	16			.69			S. S. W.	Cloudy
4	57	32	25						W. S. W.	Cloudy
5	51	35	16						W.	Clear
6	48	20	28						N. W.	Clear
7	48	23	25			.06			S.	Partly cloudy
8	46	20	26						N. N. W.	Clear
9	50	18	32						N. E.	Clear
10	61	30	31						S. W.	Clear
11	75	38	37						S. W.	Clear
12	71	44	27						E.	Cloudy
13	49	27	22						W.	Clear
14	54	48	6						W.	Clear
15	67	30	37						S. S. E.	Clear
16	61	36	25						W. N. W.	Partly cloudy
17	53	37	16			.18			S. E.	Cloudy
18	54	30	24						W. N. W.	Clear
19	37	18	19						W. N. W.	Clear
20	54	27	27						W. S. W.	Partly cloudy
21	67	40	27						S. W.	Clear
22	61	37	24			.06			E. S. E.	Partly cloudy
23	63	40	23						E. N. E.	Cloudy
24	30	28	2					2 inches	N. E.	Cloudy
25	42	23	19			1 28			N. N. E.	Cloudy
26	44	30	14						N. W.	Partly cloudy
27	42	23	19						N. W.	Clear
28	50	22	28						N. W.	Clear
29	45	29	16			.20			N. N. E.	Cloudy
30	37	17	20						N. N. E.	Clear
Sum	1587	918	.....			2.47				
Mean	52.9	30.6	.....							

† Including rain, hail, sleet and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 52.9; Mean minumum, 30.6; Mean, 41.75; Maximum, 67; Date, 15 and 21; Minimum, 17; Date, 30; Greatest daily range, 37.

Precipitation—Total, 2.47 inches; Greatest in 24 hours, 1.28; Date, 25.

Snow—Total fall, 2 inches; on ground 15th, 0 inches; at end of month, 0 inches.

Number of Days—With .01 inch or more precipitation, 6; Clear, 16; Partly cloudy, 5; Cloudy, 9.

Meteorological Record: Month of December, 1909.

December, 1909.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	39	15	24						N.	Clear
2	36	21	15						N. N. E.	Partly cloudy
3	40	32	8						N. N. E.	Cloudy
4	40	26	14						N.	Partly cloudy
5	49	33	16						N. N. W.	Clear
6	52	25	27						W. N. W.	Clear
7	53	23	30			.58			W. N. W.	Cloudy
8	38	23	15						W. N. W.	Clear
9	32	17	15						W.	Clear
10	33	17	16						W. S. W.	Clear
11	28	16	12						W. N. W.	Clear
12	32	8	24						N. W.	Clear
13	35	16	19				1.25		N.	Cloudy
14	43	35	8			1.93			S.	Cloudy
15	48	33	15						W.	Partly cloudy
16	38	27	11						W.	Clear
17	34	23	11						W.	Clear
18	34	22	12						W.	Clear
19	32	13	19						W.	Clear
20	33	15	18						W.	Clear
21	32	23	9						N. W.	Clear
22	28	18	10						W. N. W.	Partly cloudy
23	37	23	14						W. N. W.	Partly cloudy
24	31	20	11						N.W.	Partly cloudy
25	31	4	27						N. W.	Partly cloudy
26	28	24	4			.38	11.3	11.3	N. N. E.	Cloudy
27	24	15	9						N. W.	Clear
28	27	2	25						W.	Partly cloudy
29	30	—7	37			.02	.6		W.	Partly cloudy
30	10	—6	16						W.	Clear
31	23	—1	24						W. N. W.	Clear
Sum	1170	555				2.91	13.15			
Mean	37.7	17.9								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 37.7; Mean minimum, 17.9; Mean, 27.8; Maximum, 53; Date, 7; Minimum, —7; Date, 29; Greatest daily range, 37.

Precipitation—Total, 2.91 inches; Greatest in 24 hours, 1.93; Date, 14.

Snow—Total fall, 13.15 inches; on ground 15th, 0 inches; At end of month, 0 inches.

Number of Days—With .01 inch or more precipitation, 5; Clear, 17; Partly cloudy, 9; Cloudy, 5.

Meteorological Record: Month of January, 1910.

January, 1910.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	25	—5	30						W. N. W.	Clear
2	47	—0	47						S. W.	Clear
3	29	22	7			.02	.5		W.	Cloudy
4	3	—4	7						N. W.	Clear
5	14	—17	31						N. W.	Cloudy
6	39	—8	47			1.35			W. N. W.	Cloudy
7	37	22	15			.10			N. E.	Cloudy
8	37	9	28						N. W.	Clear
9	36	8	28						N. W.	Clear
10	29	17	12						N. N. E.	Clear
11	32	22	10						N. W.	Clear
12	32	11	21						N. W.	Clear
13	35	4	31						N. W.	Clear
14	18	4	14						N. N. E.	Cloudy
15	32	11	21			.05	8		N. N. E.	Cloudy
16	45	17	28						N.	Clear
17	34	13	21						N.	Clear
18	45	19	26			20			N.	Cloudy
19	40	33	7						W.	Clear
20	43	20	23						W.	Clear
21	48	18	30						W. N. W.	Cloudy
22	47	20	27			.53			S. S. E.	Cloudy
23	47	30	17						S. W.	Cloudy
24	47	20	27						S. W.	Cloudy
25	38	20	18			.20			E.	Cloudy
26	46	20	26						N. E.	Clear
27	36	23	13			.02			N. E.	Cloudy
28	39	30	9						W. S. W.	Partly cloudy
29	35	27	8			.43			N. N. E.	Cloudy
30	35	23	12						W.	Clear
31	33	23	10						W. S. W.	Partly cloudy
Sum	1103	452	641			2.90	8 5			
Mean	35.5	14.2	20.6							

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum 35.5; Mean minimum 14.2; Mean, 24.85; Maximum, 48; Date, 21; Minimum, —17; Date, 5; Greatest daily range, 47.

Precipitation—Total, 2.9 inches; Greatest in 21 hours, 1.35; Date, 6;

Snow—Total fall, 8.5 inches; on ground 15th, 8 inches; At end of month, 1 inch.

Number of Days—With .01 inch or more precipitation, 9; Clear, 15; Partly cloudy, 2; Cloudy, 14.

Meteorological Record: Month of February, 1910.

February, 1910.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	33	15	18						N. N. W.	Clear
2	36	8	28						N.	Clear
3	36	23	13						N.	Cloudy
4	33	22	11			.76	16		N. N. E.	Cloudy
5	33	12	21						N. W.	Partly cloudy
6	15	2	13						W.	Clear
7	14	—8	22						W. N. W.	Clear
8	36	5	31						W. N. W.	Clear
9	45	13	32						W.	Partly cloudy
10	33	14	19						W.	Clear
11	29	5	24						W. N. W.	Clear
12	29	7	22			.81	15		N. N. E.	Cloudy
13	27	7	20						W. S. W.	Clear
14	33	6	27						W. N. W.	Clear
15	35	10	25						W.	Clear
16	53	23	30						W. N. W.	Partly cloudy
17	23	18	5			.67	10½		N. W.	Cloudy
18	28	13	15						N. N. E.	Cloudy
19	27	—2	29						N. W.	Clear
20	38	2	36						W.	Clear
21	52	19	33						W.	Clear
22	37	23	14						E. N. E.	Cloudy
23	28	16	12			.30	7		N. W.	Cloudy
24	21	12	—9						W.	Clear
25	25	—12	37						W.	Clear
26	24	—11	35						W. N. W.	Clear
27	54	24	30						S. S. W.	Cloudy
28	55	38	17			.40			S. W.	Cloudy
Sum	928	404	628			2.94	48½			
Mean	33.1	14.4	22.4							

† Including rain, hail, sleet and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 33.1; Mean minimum, 14.4; Mean, 23.75; Maximum, 55; Date, 28; Minimum —12; Date, 25; Greatest daily range, 37.

Precipitation—Total 2.94 inches; Greatest in 24 hours, .81 inches; Date, 12.

Snow—Total fall, 48.5 inches; on ground 15th, 20 inches; At end of month, 6 inches.

Number of Days—With .01 inch or more precipitation, 5; Clear, 16; Partly cloudy, 4; Cloudy, 8.

Meteorological Record: Month of March, 1910.

March, 1910.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	36	30	6			.02			N. E.	Cloudy
2	38	31	7						N. E.	Cloudy
3	49	28	21						E. N. E.	Clear
4	44	26	18						W.	Clear
5	51	22	29						S. S. E.	Partly cloudy
6	48	25	23						N. E.	Clear
7	46	33	13			.02			N. N. W.	Cloudy
8	37	27	10						W. S. W.	Clear
9	43	37	6						W.	Clear
10	43	18	25						W. N. W.	Clear
11	38	16	22						W. S. W.	Clear
12	42	18	24						W. S. W.	Clear
13	46	19	27			.05			N. N. E.	Clear
14	39	29	10						W.	Clear
15	44	17	27						W. S. W.	Clear
16	46	18	28						N. W.	Clear
17	31	18	13						N. W.	Cloudy
18	35	7	28						N. W.	Clear
19	52	13	39						S. S. W.	Clear
20	62	32	30						S. S. W.	Clear
21	48	30	18						N. W.	Clear
22	57	28	29						S. W.	Cloudy
23	53	35	18						S. W.	Clear
24	64	23	41						S. E.	Clear
25	76	51	25						W. S. W.	Partly cloudy
26	48	38	10						S. S. W.	Clear
27	54	34	20						N. W.	Clear
28	58	28	30						S. S. E.	Clear
29	73	34	39						S. S. W.	Clear
30	53	43	10						W. N. W.	Partly cloudy
31	46	38	8			.05			E. S. E.	Cloudy
Sum	1500	844				.14				
Mean	48.4	27.2								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 48.4; Mean minimum, 27.2; Mean, 37.8; Maximum, 76; Date, 25; Minimum, 7; Date, 18; Greatest daily range, 41.

Precipitation—Total, .14 inches; Greatest in 24 hours, .05; Date, 13 and 31.

Number of Days—With .01 inch or more precipitation, 4; Clear, 23; Partly cloudy, 5; Cloudy, 3.

Meteorological Record: Month of April, 1910.

April, 1910	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	64	32	32			.05			S. E.	Cloudy
2	63	29	34						W. N. W.	Partly cloudy
3	63	32	31						N. W.	Clear
4	64	25	39						S. S. E.	Clear
5	72	45	27						S. S. E.	Partly cloudy
6	72	39	33						S. E.	Partly cloudy
7	63	39	24						E. S. E.	Partly cloudy
8	46	38	8			.20			N. W.	Cloudy
9	52	34	18						N. W.	Clear
10	53	36	17						N. W.	Cloudy
11	53	33	20						N. W.	Clear
12	47	34	13						W. N. W.	Clear
13	57	26	31						N. W.	Clear
14	64	28	36						W. N. W.	Clear
15	61	43	18						W. N. W.	Clear
16	66	34	32						N. W.	Clear
17	48	23	25						S. E.	Clear
18	53	39	14						S. E.	Clear
19	65	42	23			.13			S. E	Cloudy
20	55	43	12			.03			S. E.	Cloudy
21	58	32	26						E. S. E.	Clear
22	56	42	14			.51			N. E.	Cloudy
23	61	42	19			.02			N. E.	Cloudy
24	61	43	18			.03			E.	Cloudy
25	52	41	11			.03			E.	Cloudy
26	56	43	13			1.06			E.	Cloudy
27	68	45	23						S. E.	Clear
28	50	37	13						N. W.	Clear
29	49	26	23						S. W.	Clear
30	56	40	16			.41			S. S. E.	Cloudy
Sum	1758	885				2.47				
Mean	58.6	29.5								

†Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 58.6; Mean minimum, 29.5; Mean, 44; Maximum, 72; Date, 5 and 6; Minimum, 23; Date, 17; Greatest daily range, 39.

Precipitation—Total, 2.47 inches; Greatest in 24 hours, 1.06; Date, 26.

Number of Days—With .01 inch or more precipitation, 10; Clear, 15; Partly cloudy, 4; Cloudy, 11.

Meteorological Record: Month of May, 1910.

May, 1910.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	57	42	15						E. N. E.	Clear
2	49	36	13						E. S. E.	Partly cloudy
3	58	40	18			.08			E. S. E.	Cloudy
4	53	42	11			.21			N. N. E.	Cloudy
5	50	38	12			.13			N. N. E.	Cloudy
6	58	29	29						E. N. E.	Clear
7	68	35	33			.02			W. N. W.	Cloudy
8	77	38	39						W. S. W.	Cloudy
9	63	52	11			.02			S. W.	Cloudy
10	65	49	16						W. N. W.	Cloudy
11	64	53	11						W. S. W.	Clear
12	62	34	28						N. E.	Clear
13	52	35	17						E. N. E.	Cloudy
14	62	40	22						E.	Partly cloudy
15	63	37	26			.06			N. N. E.	Clear
16	64	41	23						N. N. E.	Clear
17	78	38	40						S. S. E.	Clear
18	63	42	21			.37			S. S. W.	Partly cloudy
19	63	46	17						W. N. W.	Partly cloudy
20	82	44	38						N. W.	Clear
21	60	52	8			.06			S. E.	Cloudy
22	61	47	14						E. N. E.	Cloudy
23	65	48	17						S. E.	Cloudy
24	87	53	34						S.	Cloudy
25	79	63	16						S. W.	Partly cloudy
26	78	61	17						S. W.	Partly cloudy
27	73	48	25						S. S. W.	Clear
28	73	53	20						N. N. E.	Clear
29	69	61	8						S. S. E.	Clear
30	63	45	18			.32			E. N. E.	Partly cloudy
31	61	48	13						S. W.	Clear
Sum.	1924	1290				1.27				
Mean	62 1	41.1								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 62.1; Mean minimum, 41.1; Mean, 51.6; Maximum, 87; Date, 24; Minimum, 29; Date, 6; Greatest daily range, 40.

Precipitation—Total, 1.27 inches; Greatest in 24 hours, .37; Date, 18.

Number of Days—With .01 inch or more precipitation, 9; Clear, 12; Partly cloudy, 7; Cloudy, 12.

Meteorological Record: Month of June, 1910.

June, 1910.	Temperature.			Precipitation.					Prevailing wind direction.	Character of day.
	Maximum.	Minimum.	Range.	Time of beginning.	Time of ending.	†Amount.	Snowfall in inches.	Depth of snow on ground at time of observation.		
1	63	47	16						S. S. W.	Clear
2	67	43	24						S. W.	Clear
3	73	42	31						W. S. W.	Partly cloudy
4	73	40	33						S. E.	Clear
5	57	39	18						S. E.	Clear
6	57	45	12			.82			E. S. E.	Cloudy
7	64	43	21			.24			E. S. E.	Partly cloudy
8	67	43	24						W. N. W.	Clear
9	83	47	36						N. W.	Clear
10	55	52	3			.26			E. N. E.	Cloudy
11	54	49	5			.55			E. N. E.	Cloudy
12	59	47	12			.40			E. N. E.	Cloudy
13	79	49	30						W. S. W.	Partly cloudy
14	83	58	25						W. S. W.	Clear
15	78	54	24						N. W.	Clear
16	69	48	21						E. N. E.	Clear
17	63	54	9			.67			E. N. E.	Cloudy
18	74	57	17			.15			N. N. E.	Cloudy
19	83	57	26						N. N. E.	Clear
20	87	54	33						N. N. W.	Clear
21	91	60	31						N. W.	Clear
22	88	60	28						N. W.	Clear
23	82	68	14						W. N. W.	Clear
24	73	49	24			.07			N. W.	Partly cloudy
25	74	50	24						E. S. E.	Clear
26	84	50	34						W. N. W.	Clear
27	80	60	20			.11			W. S. W.	Cloudy
28	82	63	19						S. W.	Partly cloudy
29	76	56	20						N. W.	Clear
30	83	57	26						N. W.	Clear
Sum	2201	1540				3.27				
Mean	73.4	51.3								

† Including rain, hail, sleet, and melted snow.

MONTHLY SUMMARY.

Temperature—Mean maximum, 73.4; Mean minimum, 51.3; Mean, 62.3; Maximum, 91; Date, 21; Minimum, 39; Date, 5; Greatest daily range, 36.

Precipitation—Total, 3.27 inches; Greatest in 24 hours, .82; Date, 6.

Number of Days—With .01 inch or more precipitation, 9; Clear, 18; Partly cloudy, 5; Cloudy, 7.

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